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SUPPLEMENT.

THE POLITICAL DESTINY OF CANADA.

By GOLDWIN SMITH.

IGNORANCE of the future can hardly be good for any man or nation; nor can forecast of the future in the case of any man or nation well interfere with the business of the present, though the language of colonial politicians seems often to imply that it may. No Canadian farmer would take his hand from the plough, no Canadian artisan would desert the foundery or the loom, no Canadian politician would become less busy in his quest of votes, no industry of any kind would slacken, no source of wealth would cease to flow, if the rulers of Canada and the powers of Downing Street, by whom the rulers of Canada are supposed to be guided, instead of drifting on in darkness, knew for what port they were steering.

For those who are actually engaged in moulding the institutions of a young country not to have formed a conception of her destiny—not to have made up their minds whether she is to remain forever a dependency, to blend again in a vast confederation with the monarchy of the mother-country, or to be united to a neighboring republic — would be to renounce statesmanship. The very expenditure into which Canada is led by her position as a dependency in military and political railways, in armaments and defenses, and other things which assume the permanence of the present system, is enough to convict Canadian rulers of flagrant improvidence if the permanency of the present system is not distinctly established in their minds.

To tax forecast with revolutionary designs or tendencies is absurd. No one can be in a less revolutionary frame of mind than he who foresees a political event without having the slightest interest in hastening its arrival. On the other hand, mere party politicians cannot afford to see beyond the hour. Under the system of party government, forecast and freedom of speech alike belong generally to those who are not engaged in public life.

The political destiny of Canada is here considered by itself, apart from that of any other portion of the motley and widely-scattered "empire." This surely is the rational course. Not to speak of India and the military dependencies, such as Malta and Gibraltar, which have absolutely nothing in common with the North American colonies (India not even the titular form of government, since its sovereign has been made an empress), who can believe that the future of Canada, of South Africa, of Australia, of the West Indies, and of Mauritius, will be the same? Who can believe that the mixed French and English population of Canada, the mixed Dutch and English population of the Cape, the negro population of Jamaica, the French and Indian population of Mauritius, the English and Chinese population of Australia, are going to run forever the same political course? Who can believe that the moulding influences will be the same in arctic continents or in tropical islands as in countries lying within the temperate zone? Among the colonies, those, perhaps, which most nearly resemble each other in political character and circumstances, are Canada and Australia; yet the elements of the population are very different—and still more different are the external relations of Australia, with no other power near her, from those of Canada, not only conterminous with the United States,

but interlaced with them, so that at present the road of the Governor-General of Canada, when he visits his Pacific province, lies through the territory of the American Republic. Is it possible to suppose that the slender filament which connects each of these colonies with Downing Street is the thread of a common destiny?

In studying Canadian politics, and in attempting to cast the political horoscope of Canada, the first thing to be remembered, though official optimism is apt to overlook it, is that Canada was a colony not of England but of France, and that between the British of Ontario and the British of Nova Scotia and New Brunswick are interposed, in solid and unyielding mass, above a million of unassimilated and politically antagonistic Frenchmen. French Canada is a relic of the historical past preserved by isolation, as Siberian mammoths are preserved in ice. It is a fragment of the France before the Revolution, less the monarchy and the aristocracy; for the feeble parody of French feudalism in America ended with the abolition of the seigniories, which may be regarded as the final renunciation of feudal ideas and institutions by society in the New World. The French-Canadians are an unprogressive, religious, submissive, courteous, and, though poor, not unhappy people. They would make excellent factory-hands if Canada had a market for her manufactures; and, perhaps, it is as much due to the climate as to their lack of intelligent industry, that they have a very indifferent reputation as farmers. They are governed by the priest, with the occasional assistance of the notary; and the Roman Catholic Church may be said to be still established in the province, every Roman Catholic being bound to pay tithes and other ecclesiastical imposts, though the Protestant minority are exempt. The Church is immensely rich, and her wealth is always growing, so that the economical element which mingled with the religious causes of the Reformation may one day have its counterpart in Quebec. The French-Canadians, as we have said, retain their exclusive national character. So far from being absorbed by the British population, or Anglicized by contact with it, they have absorbed and Gallicized the fragments of British population which chance has thrown among them; and the children of Highland regiments disbanded in Quebec have become thorough Frenchmen, and prefixed Jean Baptiste to their Highland names. For his own Canada the Frenchman of Quebec has something of a patriotic feeling; for France he has filial affection enough to make his heart beat violently for her during a Franco-German War; for England, it may be safely said, he has no feeling whatever. It is true that he fought against the American invaders in the Revolutionary War, and again in 1812; but then he was animated by his ancient hostility to the Puritans of New England, in the factories of whose descendants he now freely seeks employment. Whether he would enthusiastically take up arms for England against the Americans at present, the British War-Office, after the experience of the two Fenian raids, can no doubt tell. With Upper Canada, the land of Scotch Presbyterians, Irish Orangemen, and ultra-British sentiment, French Canada, during the union of the two provinces, led an uneasy life; and she accepted confederation, on terms which leave her nationality untouched, rather as a severance of her special wedlock with her unloved consort than as a measure of North American union. The unabated antagonism between the two races and the two religions was plainly manifested on the occasion of the conflict between the French half-breeds and the British immigrants in Manitoba, which presented a faint parallel to the conflict between the advanced posts of slavery and antislavery in Kansas on the eve of the civil war; Quebec openly sympathizing with Riel and his fellow-insurgents, while Ontario was on fire to avenge the death of Scott. Sir George Cartier might call himself an Englishman speaking French; but his calling himself so did not make him so; much less did it extend the character from a political manager, treading the path of ambition with British colleagues, to the mass of his unsophisticated compatriots. The priests hitherto have put their interests into the hands of a political leader, such as Sir George himself, in the same way in which the Irish priests used to put their interests into the hands of O'Connell; and this leader has made the best terms he could for them and for himself at Ottawa. Nor has it been difficult to make good terms, since both the political parties bid emulously for the Catholic vote, and, by their interested subserviency to those who wield it, render it impossible for a Liberal Catholic party, or a Liberal party of any kind, to make head against priestly influence in Quebec. By preference the priests, as reactionists, have allied themselves with the Tory party in the British provinces, and Canada has long witnessed the singular spectacle, witnessed for the first time in England at the last general election, of Roman Catholics and Orangemen marching together to the poll. Fear of contact with an active-minded democracy, and of possible peril

to their overweening wealth, has also led the priesthood to shrink from annexation, though they have not been able to prevent their people from going over the line for better wages, and bringing back with them a certain republican leaven of political and ecclesiastical unrest, which in the end may, perhaps, lead to the verification of Lord Elgin's remark, that it would be easier to make the French-Canadians Americans than to make them English. Hitherto, however, French Canada has retained, among other heirlooms of the *Ancien Régime*, the old Gallican Church, the Church of Louis XIV. and of Bossuet, national, quiet, unaggressive, capable of living always on sufficiently good terms with the state. But now the scene is changed. Even to French Canada, the most secluded nook of the Catholic world, Ultramontanism has penetrated, with the Jesuit in its van. There is a struggle for ascendency between the Jesuits and the Gallicans, the citadel of the Gallicans being the Sulpician Seminary, vast and enormously wealthy, which rises over Montreal. The Jesuit has the forces of the hour on his side; he gains the day; the bishops fall under his influence, and take his part against the Sulpicians; the Guibord case marks, distinctly though farcically, the triumph of his principles; and it is by no means certain that he, a cosmopolitan power playing a great game, will cling to Canadian isolation, and that he will not prefer a junction with his main army in the United States. Assuredly his choice will not be determined by loyalty to England. At all events, his aggressive policy has begun to raise questions calculated to excite the Protestants of the British provinces, which the politicians, with all their arts, will hardly be able to smother, and which will probably put an end to the long torpor of Quebec. The New Brunswick school case points to education as a subject which can scarcely fail soon to give birth to a cause of war.

Besides the French, there are in Canada, as we believe we have good authority for saying, about 400,000 Irish, whose political sentiments are generally identical with those of the Irish in the mother-country, as any reader of their favorite journals will perceive. Thus, without reckoning a considerable German settlement in Ontario, which by its unimpaired nationality in the heart of the British population attests the weakness of the assimilating forces in Canada compared with those in the United States, or the Americans, who, though not numerous, are influential in the commercial centres, we have at once to deduct 1,400,000 from a total population of less than 4,000,000 in order to reduce to reality the pictures of universal devotion to England and English interests which are presented by the speeches of official persons, or of persons professing to know Canada, but deriving their idea of her from the same source.

Confederation, so far, has done nothing to fuse the races, and very little even to unite the provinces. New Brunswick and Nova Scotia, besides being cut off from Ontario by French Canada, have interests of their own, separate, and in some degree divergent, from those of Ontario, New Brunswick especially being drawn by her commercial interests toward New England. The representatives of each of the smaller provinces form a separate group at Ottawa, giving or withholding their support to a great extent from provincial considerations. Each of the two political parties has its base in Ontario, which is the field of the decisive battles; and they can hardly be said to extend to the maritime provinces, much less to Manitoba or to British Columbia. When the Ontarian parties are evenly balanced the smaller provinces turn the scale, and Ontarian leaders are always buying them with "better terms," that is, alterations of the pecuniary arrangements of confederation in their favor, and other inducements, at the sacrifice, of course, of the general interests of the Confederation. From the composition of a cabinet to the composition of a rifle-team, sectionalism is the rule. Confederation has secured free-trade between the provinces; what other good it has done it would not be easy to say. Whether it has increased the military strength of Canada is a question for the answer to which we must appeal once more to the British War-Office. Canadians have shown, on more than one memorable occasion, that in military spirit they are not wanting; but they cannot be goaded into wasting their hardly-earned money on preparations for a defense which would be hopeless against an invader who will never come. Politically, the proper province of a federal government is the management of external relations, while domestic legislation is the province of the several states. But a dependency has no external relations; Canada has not even, like South Africa, a native question, her Indians being perfectly harmless; and consequently the chief duty of a federal government in Canada is to keep itself in existence by the ordinary agencies of party, a duty which it discharges with a vengeance. English statesmen bent on extending to all the colonies what they assume to be the benefits of confederation, should study the

Canadian specimen, if possible, on the spot. They will learn, first, that while a spontaneous confederation, such as groups of states have formed under the pressure of a common danger, develops mainly the principles of union, a confederation brought about by external influence is apt to develop the principles of antagonism in at least an equal degree; and, secondly, that parliamentary government in a dependency is, to a lamentable extent, government by faction and corruption, and that by superadding federal to provincial government the extent and virulence of those maladies are seriously increased. If an appeal is made to the success of confederation in Switzerland, the answer is, that Switzerland is not a dependency but a nation.

It is of Canada alone that we here speak, and we speak only of her political destiny. The ties of blood, of language, of historical association, and of general sympathy, which bind the British portion of the Canadian people to England, are not dependent on the political connection, nor is it likely that they would be at all weakened by its severance. In the United States there are millions of Irish exiles, with the wrongs of Ireland in their hearts, and the whole nation retains the memories of the Revolutionary War, of the War of 1812, and of the conduct of the British aristocracy toward the United States during the rebellion of the South—conduct which it is difficult to forgive, and which it would be folly to forget. Yet to those who have lived among the Americans it will not seem extravagant to say that the feelings of an Anglo-American toward his mother-country are really at least as warm as those of the natives of dependencies, and at least as likely to be manifested by practical assistance in the hour of need. A reference to the history of the opposition made to the War of 1812 will suffice at least to bring this opinion within the pale of credibility.

The great forces prevail. They prevail at last, however numerous and apparently strong the secondary forces opposed to them may be. They prevailed at last in the case of German unity and in the case of Italian independence. In each of those cases the secondary forces were so heavily massed against the event that men renowned for practical wisdom believed the event would never come. It came, irresistible and irrevocable, and we now see that Bismarck and Cavour were only the ministers of Fate.

Suspended of course, and long suspended, by the action of the secondary forces, the action of the great forces may be. It was so in both the instances just mentioned. A still more remarkable instance is the long postponement of the union of Scotland with England by the antipathies resulting from the abortive attempt of Edward I., and by a subsequent train of historical accidents, such as the absorption of the energies of England in Continental or civil wars. But the union came at last, and, having the great forces on its side, it came forever.

In the case before us, it appears that the great forces are those which make for the political separation of the New from the Old World. They are:

1. The distance, which may be shortened by steam and telegraph for the transmission of a despot's commands, but can hardly be much shortened for the purposes of representative government. Steam increases the transatlantic intercourse of the wealthier class, but not that of the people, who have neither money nor time for the passage. Everything is possible in the way of nautical invention; fuel may be still further economized, though its price is not likely to fall; but it is improbable that the cost of ship-building or the wages of seamen will be reduced; and the growth of manufactures in the New World, which we may expect henceforth to be rapid, can hardly fail to diminish the intercourse dependent on transatlantic trade. A commonwealth spanning the Atlantic may be a grand conception, but political institutions must after all bear some relation to Nature and to practical convenience. Few have fought against geography and prevailed.

2. Divergence of interest, which seems in this case to be as wide as possible. What has Canada to do with the European and Oriental concerns of England, with her European and Oriental diplomacy, with her European and Oriental wars? Can it be conceived that Canadian traders would allow her commerce to be cut up by Russian cruisers, or that Canadian farmers would take arms and pay war-taxes in order to prevent Russia from obtaining a free passage through the Dardanelles? An English pamphlet called "The Great Game" was reprinted the other day in Canada; but the chapter on India was omitted, as having no interest for Canadians. For English readers that chapter had probably more interest than all the other chapters put together. On the other hand, whenever a question about boundaries or mutual rights arises with the United States, the English people and the English Government betray, by the languor of their diplomacy and the ease with which they yield, their

comparative indifference to the objects in which Canada is most concerned. A Canadian periodical some time ago had a remarkable paper by a native writer, showing that the whole series of treaties made by Great Britain with the United States had been a continuous sacrifice of the claims of Canada. It was not, assuredly, that Great Britain wanted either force or spirit to fight for her own rights and interests, but that she felt that Canadian rights and interests were not her own. Her rulers could not have induced her people to go to war for an object for which they cared so little, and had so little reason to care, as a frontier line in North America. Another illustration of the difference between the British and the Canadian point of view was afforded by the recent dispute about the Extradition Treaty: England was disposed to be stiff and punctilious, having comparatively little to fear from the suspension of the treaty; while to Canada, bordering on the United States, the danger was great, and the renewal of the treaty was a vital necessity before which punctiliousness gave way. One object there is connected with the American Continent for which the British aristocracy, if we may judge by the temper it showed and the line it took toward the American Republic at the time of the rebellion, would be not unwilling to run the risk of war. But that object is one with regard to which the interests of British aristocracy and those of Canadian democracy not only are not identical, but point directly opposite ways. With regard to economical questions, the divergence is, if possible, still clearer than with regard to diplomatic questions. The economic interests of Canada must evidently be those of her own continent, and to that continent, by all the economic forces, she must be and visibly is drawn. Her currency, whatever may be the name and superscription on the coin, is American, and it is the sure symbol of her real connection. In the British manufacturer the Canadian manufacturer sees a rival; and Canada at this moment is the scene of a protectionist movement led, curiously enough, by those "Conservative" politicians who are loudest in their professions of loyalty to Great Britain.

3. More momentous than even the divergence of interest is the divergence of political character between the citizen of the Old and the citizen of the New World. We speak, of course, not of the French-Canadians, between whom and the people of Great Britain the absence of political affinity is obvious, but of the British communities in North America. The colonization of the New World, at least that English portion of it which was destined to give birth to the ruling and moulding power, was not merely a migration, but an exodus; it was not merely a local extension of humanity, but a development; it not only peopled another continent, but opened a new era. The curtain rose not for the old drama with fresh actors, but for a fresh drama on a fresh scene. A long farewell was said to feudalism when the New England colony landed, with the rough draft of a written constitution, which embodied a social compact and founded government not on sacred tradition or divine right, but on reason and the public good. The more one sees of society in the New World, the more convinced one is that its structure essentially differs from that of society in the Old World, and that the feudal element has been eliminated completely and forever. English aristocracy, fancying itself, as all established systems fancy themselves, the normal and final state of humanity, may cling to the belief that the new development is a mere aberration, and that dire experience will in time bring it back to the ancient path. There are people, it seems, who persuade themselves that America is retrograding toward monarchy and church establishments. No one who knows the Americans can possibly share this dream. Monarchy has found its way to the New World only in the exceptional case of Brazil, to which the royal family of the mother-country itself migrated, and where after all the emperor is rather an hereditary president than a monarch of the European type. In Canada, government being parliamentary and "constitutional," monarchy is the delegation of a shadow; and any attempt to convert the shadow into a substance, by introducing a dynasty with a court and civil list, or by reinvesting the viceroy with personal power, would speedily reveal the real nature of the situation. Pitt proposed to extend to Canada what as a Tory minister he necessarily regarded as the blessings of aristocracy; but the plant refused to take root in the alien soil. No peerage ever saw the light in Canada; the baronetage saw the light and no more; of nobility there is nothing now but a knighthood very small in number, and upon which the Pacific-Railway scandal has cast so deep a shadow that the home Government, though inclined that way, seems shy of venturing on more creations. Hereditary wealth and the custom of primogeniture, indispensable supports of an aristocracy, are totally wanting in a purely industrial country, where, let the law be what it might, natural justice has always protested against

the feudal claims of the first-born. To establish in Canada the state Church, which is the grand buttress of aristocracy in England, has proved as hopeless as to establish aristocracy itself. The Church lands have been secularized; the university, once confined to Anglicanism, has been thrown open; the Anglican Church has been reduced to the level of the other denominations, though its rulers still cling to the memories and to some relics of their privileged condition. As a religion, Anglicanism has little hold upon the mass of the people: it is recruited by emigration from England, and sustained to a certain extent by a social feeling in its favor among the wealthier class. More democratic churches far exceed it in popularity and propagandist force: Methodism especially, which, in contrast to Episcopacy, sedulously assigns an active part in church-work to every member, decidedly gains ground, and bids fair to become the popular religion of Canada. Nor is the militarism of European aristocracies less alien to industrial Canada than their monarchism and their affinity for state churches. The Canadians, as we have already said, can fight well when real occasion calls; so can their kinsmen across the line; but among the Canadians, as among the people of the Northern States, it is impossible to awaken militarism —every sort of galvanic apparatus has been tried in vain. Distinctions of rank, again, are wanting; everything bespeaks a land dedicated to equality; and fustian, instead of bowing to broadcloth, is rather too apt, by a rude self-assertion, to revenge itself on broadcloth for enforced submissiveness in the old country. Where the relations of classes, the social forces, and the whole spirit of society, are different, the real principles and objects of government will differ also, notwithstanding the formal identity of institutions. It proved impossible, as all careful observers had foreseen, to keep the same political roof over the heads of slavery and antislavery. To keep the same political roof over the heads of British aristocracy and Canadian democracy would be an undertaking only one degree less hopeless. A rupture would come, perhaps, on some question between the ambition of a money-spending nobility and the parsimony of a money-making people. Let aristocracy, hierarchy, and militarism, be content with the Old World; it was conquered by the feudal sword; the New World was conquered only by the axe and plough.

4. The force, sure in the end to be attractive, not repulsive, of the great American community along the edge of which Canada lies, and to which the British portion of her population is drawn by identity of race, language, religion, and general institutions; the French portion by its connection with the Roman Catholic Church of the States; the whole by economic influences, against which artificial arrangements and sentiments contend in vain, and which are gathering strength and manifesting their ascendency from hour to hour.

An enumeration of the forces which make in favor of the present connection will show their secondary and, for the most part, transient character. The chief of them appear to be these:

a. The reactionary tendencies of the priesthood which rules French Canada, and which fears that any change might disturb its solitary reign. Strong this force has hitherto been, but its strength depends on isolation, and isolation cannot be permanent. Even the "palæocrystallic" ice which envelops French Canada will melt at last, and when it does French reaction will be at an end. We have already noted two agencies which are working toward this result—the leaven of American sentiment brought back by French-Canadians who have sojourned as artisans in the States, and the ecclesiastical aggressiveness of the Jesuits.

b. "United Empire Loyalism," which has its chief seat in Ontario. Every revolution has its reaction, and in the case of the American Revolution the reaction took the form of a migration of the royalists to Canada, where lands were assigned them, and where they became the political progenitors of the Canadian Tory party, while the "Reformers" are the offspring of a subsequent immigration of Scotch Presbyterians, mingled with wanderers from the United States. The two immigrations were arrayed against each other in 1837, when, though the United Empire Loyalists were victorious in the field, the political victory ultimately rested with the Reformers. United Empire Loyalism is still strong in some districts, while in others the descendants of royalist exiles are found in the ranks of the opposite party. But the whole party is now in the position of the Jacobites after the extinction of the house of Stuart. England has formally recognized the American Revolution, taken part in the celebration of its centenary, and through her embassador saluted its flag. Anti-revolutionary sentiment ceases to have any meaning, and its death cannot be far off.

c. The influence of English immigrants, especially in the upper ranks of the professions, in the high places of commerce, and in the press. These men have retained a certain social ascen-

dency; they have valued themselves on their birth in the imperial country and the superior traditions which they supposed it to imply; they have personally cherished the political connection, and have inculcated fidelity to it with all their might. But their number is rapidly decreasing; as they die off natives take their places, and Canada will soon be in Canadian hands. Immigration generally is falling off; upper-class immigration is almost at an end, there being no longer a demand for anything but manual labor and the influence of personal connection with England will cease to rule. The press is passing into the hands of natives, who are fast learning to hold their own against imported writing in literary skill, while they have an advantage in their knowledge of the country.

d. While the British troops remained in Canada, their officers formed a social aristocracy of the most powerful kind, and exercised a somewhat tyrannical influence over opinion. The traces of this influence still remain, but, with the exception of the reduced garrison of Halifax, the military occupation has ceased, and is not likely to be renewed.

e. The Anglican Church in Canada clings to its position as a branch of the great state Church of England, and, perhaps, a faint hope of reëstablishment may linger in the breasts of the bishops, who still retain the title of "lords." We have already said that the roots of Anglicanism in Canada do not appear to be strong, and its chief source of reënforcement will be cut off by the discontinuance of upper-class emigration. It is rent in Canada, as in England, by the conflict between the Protestants and the Ritualists; and in Canada, there being no large endowments or legal system to clamp the hostile elements together, discord has already taken the form of disruption. As to the other churches, they have a connection with England, but not with England more than with the United States. The connection of Canadian Methodism with the United States is very close.

f. Orangism is strong in British Canada, as indeed is every kind of association except the country. It retains its filial connection with its Irish parent, and is ultra-British on condition that Great Britain continues anti-papal. Old Irish quarrels are wonderfully tenacious of life, yet they must one day die, and Orangism must follow them to the grave.

g. The social influence of English aristocracy, and of the little court of Ottawa over colonists of the wealthier class. With this (to dismiss at once a theme more congenial to the social humorist than to the political observer) we may couple the influence of those crumbs of titular honor which English aristocracy sometimes allows to fall from its table into colonial mouths. If such forces cannot be said to be transient, the tendencies of human nature being perpetual, they may at least be said to be secondary; they do not affect the masses, and they do not affect the strong.

h. Antipathy to the Americans, bred by the old wars, and nursed by British influences, military and aristocratic, not without the assistance of the Americans themselves, who, in the case of the Fenian raids, and in other cases, have vented on Canada their feelings against England. This antipathy, so far as it prevails, leads those who entertain it to cling to an anti-American connection. But, generally speaking, it is very hollow. It does not hinder young Canadians from going by hundreds to seek their fortunes in the United States. It does not hinder wealthy Americans who have settled in Canada from finding seats at once in the Canadian Parliament. It never, in fact, goes beyond talk. So far as it partakes of the nature of contempt, it can hardly fail to be modified by the changed attitude of the British aristocracy, who have learned to exhibit something more than courtesy toward the victorious republic; while the Americans, it may be reasonably presumed, now that the cause of irritation is removed, will not think it wise to make enemies of a people whose destinies are inextricably blended with their own.

i. The special attachment naturally felt by the politicians, as a body, to the system with reference to which their parties have been formed, and with which the personal ambition of most of them is bound up. Perhaps, of all the forces which make for the present connection, this is the strongest; it has proved strong enough, when combined with the timidity and the want of independence which life-long slavery to a faction always breeds, to prevent any Canadian politician from playing a resolute part in such efforts as there have been to make Canada a nation. In some cases it is intensified by commercial connections with England, or by social aspirations, more or less definite, which have England for their goal. In this respect the interest of the politicians, as a class, is distinct from, and is liable to clash with, the real interest of the community at large. So, in the case of Scotland, it was the special interest of the politicians to resist the union, as, without special pressure and inducements, they would probably have persisted

in doing. It was the interest of the people to accept the union, as the flood of prosperity which followed its acceptance clearly showed. In the case of Scotland, the interest of the people triumphed at last, and it will probably triumph at last in Canada.

Such, we say, are the chief forces that make for the existing connection; and we repeat that they appear to be secondary, and, for the most part, transient. United, all these strands may make a strong cable; but, one by one they will give way, and the cable will cease to hold. This conviction is quite consistent with the admission that the connectionist sentiment is now dominant, especially in Ontario; that in Ontario it almost exclusively finds expression on the platform and in the press; and that the existence of any other opinions can only be inferred from reticence, or discovered by private intercourse. A visitor may thus be led to believe and to report that the attachment of the whole population to the present system is unalterable, and that the connection must endure forever. Those who have opportunities of looking beneath the surface may, at the same time, have grounds for thinking that, on economical subjects at least, the people have already entered on a train of thought which will lead them to a different goal.

What has been the uniform course of events down to the present time? Where are the American dependencies of Spain, Portugal, France, and Holland? Those on the continent, with unimportant exceptions, are gone, and those in the islands are going; for few suppose that Spain can keep Cuba very long. Of the English colonies on the continent, the mass, and those that have been long founded, have become independent; and every one now sees, what clear-sighted men saw at the time, that the separation was inevitable, and must soon have been brought about by natural forces, apart from the accidental quarrel. If Canada has been retained, it is by the reduction of imperial supremacy to a form. Self-government is independence; perfect self-government is perfect independence; and all the questions that arise between Ottawa and Downing Street, including the recent question about appeals, are successively settled in favor of self-government. Diplomatic union between two countries in different hemispheres, with totally different sets of external relations, common responsibility for each other's quarrels, and liability to be involved in each other's wars—these incidents of dependence remain, and these alone. Is it probable that this last leaf can continue to flutter on the bough forever? Lord Derby some years ago said that everybody knew that Canada must soon be an independent nation. Now he thinks the tide of opinion has turned in favor of imperialism, and he turns with the tide. But what he takes for the turn of the tide may be merely the receding wave; and he forgets what the last wave swept away. It swept away the military occupation, with all its influences, political and social. Even since that time the commercial unity of the empire has been formally abandoned in the case of the Australian tariffs; and now the marriage-law of the colonies is clashing with that of the mother-country in the British House of Commons.

It is, perhaps, partly the recoil of feeling from a severence felt to be imminent, as well as the temporary influence of Conservative reaction in England, that has led to the revival in certain quarters, with almost convulsive vehemence, of the plan of imperial confederation. Certainly, if such a plan is ever to be carried into effect, this is the propitious hour. The spirit of aggrandizement is in the ascendant, and the colonies are all on good terms with the mother-country. Yet, of the statesmen who dally with the project and smile upon its advocates, not one ventures to take a practical step toward its fulfillment. On the contrary, they are accessory to fresh inroads upon imperial unity, both in the judicial and in the fiscal sphere. Colonial governors talk with impressive vagueness of some possible birth of the imperial future, as though the course of events, which has been hurrying the world through a series of rapid changes for the last century, would now stand still, and impracticable aspirations would become practicable by the mere operation of time; but no colonial governor or imperial statesman has ventured to tell us, even in the most general way, to what it is that he looks forward, how it is to be brought about, or even what dependencies the confederation is to include. It is, therefore, needless to rehearse all the arguments against the feasibility of such a scheme. The difficulties which beset the union under the same parliamentary government of two countries in different parts of the world, with different foreign relations, and differing internally in political spirit, would, of course, be multiplied in the case of a union of twenty or thirty countries scattered over the whole globe, bound together by no real tie of common interest, and ignorant of each other's concerns. The first meeting of such a conclave would, we may be sure, develop forces of disunion far stronger than the vague sentiment

of union arising from a very partial community of descent, and a very imperfect community of language, which would be the sole ground of the federation. Even to frame the agreement as to the terms of union with the shifting parties and ephemeral cabinets of a score of colonies under constitutional government would be no easy task. The two Parliaments, the one National, the other Federal, which it is proposed to establish in order to keep the national affairs of England separate from those of the Imperial Federation, would be liable to be brought into fatal conflict, and thrown into utter confusion by the ascendency of different parties, say a war party and a peace party, in the National and the Federal House. The veriest Chinese puzzle in politics would be a practicable constitution, if you could only get the real forces to conduct themselves according to the programme. It was not in the programme of Canadian confederation that the provinces should form separate interests in the Federal Parliament, and force the party leaders to bid against each other for their support; though any one who had studied actual tendencies in connection with the system of party government might have pretty confidently predicted that such would be the result. That England would allow questions of foreign policy, of armaments, and of peace and war, to be settled for her by any councils but her own, it is surely most chimerical to suppose. A swarm of other difficulties would probably arise out of the perpetual vicissitudes of the party struggle in each colony, the consequent inability of the delegates to answer for the real action of their own governments, and the estrangement of the delegates themselves from colonial interest and connections by their necessary residence in England. An essential condition of federation appears to be tolerable equality among the members, or freedom from the ascendency of any overweening power; but, for a century to come, at least, the power of England in the Federal council would be overweening; and, to obviate this difficulty, some advocates of the scheme actually propose to repeal the union of England with Scotland and Ireland, so that she may be reduced to a manageable element of a Pan-Britannic confederation. They have surely little right to call other people disunionists, if any opprobrious meaning attaches to that term.

Supposing such a confederation to be practicable, of what use, apart from the vague feeling of aggrandizement, would it be? Where would be the advantage of taking from each of these young communities its political centre (which must also be, to some extent, its social and intellectual centre), and of accumulating them in the already overgrown capital of England? Does experience tell us that unlimited extension of territory is favorable to intensity of political life, or to anything which is a real element of happiness or of greatness? Does it not tell us that the reverse is the fact, and that the interest of history centres not in megalosaurian empires, but in states the body of which has not been out of proportion to the brain? Surely it would be well to have some distinct idea of the object to be attained before commencing this unparalleled struggle against geography and Nature. It can hardly be military strength. Military strength is not gained by dispersion of forces, by presenting vulnerable points in every quarter of the globe, or by embracing and undertaking to defend communities which, whatever may be their fighting qualities, in their policy are thoroughly unmilitary, and unmilitary will remain. Mr. Forster, in fact, gives us to understand that the Pan-Britannic Empire is to present a beneficent contrast to the military empires; that it is to be an empire of peace. But in that case it must, like other Quaker institutions, depend for its safety on the morality and forbearance of the holders of real and compact power, which is very far from being the dream of the advocates of "a great game."

In all these projects of Pan-Britannic empire there lurks the assumption of a boundless multiplication of the Anglo-Saxon race. What are the grounds for this assumption? Hitherto it has appeared that races, as they grow richer, more luxurious, more fearful of poverty, more amenable to the restraints of social pride, have become less prolific. There is reason to suppose that in the United States the Anglo-Saxon race is far less prolific than the Irish, who are even supplanting the Anglo-Saxons in some districts of England, as the home-rule compliances of candidates for northern boroughs show. But the Irish element is small compared with the vast reservoir of industrial population in China, which is now beginning to overflow, and seems as likely as the Anglo-Saxon race to inherit Australia, where it has already a strong foothold, as well as the coast of the Pacific.

Canada, however, with regard to the problem of imperial confederation stands by herself, presenting, from her connection with the United States, difficulties from which in the case of the Australian colonies the problem is free. Of this some of the advocates of the policy of aggran-

dizement show themselves aware by frankly proposing to let Canada go.

It is taken for granted that political dependence is the natural state of all colonies, and that there is something unfilial and revolutionary in proposing that a colony should become a nation. But what is a colony? We happen to have derived the term from a very peculiar set of institutions, those Roman colonies which had no life of their own, but were merely the military and political outposts of the imperial republic. With the Roman colonies may be classed the Athenian *cleruchies* and, substituting the commercial for the political object, the factories of Carthage. But colonies, generally speaking, are migrations, and, as a rule, they have been independent from the beginning. Independent from the beginning, so far as we know, were the Phœnician colonies, Carthage herself among the number. Independent from the beginning were those Greek colonies in Italy which rapidly outran their mother-cities in the race of material greatness. Independent from the beginning were the Saxon and Scandinavian colonies, and all those settlements of the Northern tribes which founded England herself with the other nations of modern Europe. So far as we can see, the original independence in each case was an essential condition of vigor and success. No Roman colony, Athenian *cleruchy*, or Carthaginian factory, ever attained real greatness. New England, the germ and organizer of the American communities, was practically independent for a long time after her foundation, the attention of the English Government being engrossed by troubles at home; but she retained a slender thread of theoretic dependence by which she was afterward drawn back into a noxious and disastrous subordination. That thread was the feudal tie of personal allegiance, a tie utterly irrational when carried beyond the feudal pale, and by the recent naturalization treaties now formally abolished; yet probably the main cause of the continued subjection of the transatlantic colonies, and of the calamities which flowed both to them and to the mother-country from that source.

It is natural that British statesmen should shrink from a formal act of separation, and that in their brief and precarious tenure of power they should be unwilling to take the burden and possible odium of such a measure upon themselves. But no one, we believe, ventures to say that the present system will be perpetual; certainly not the advocates of imperial confederation, who warn us that, unless England by a total change of system draws her colonies nearer to her, they will soon drift farther away.

Apart from lingering sentiment, it seems not easy to give reasons, so far as Canada is concerned, for struggling to prolong the present system. The motives for acquiring and holding dependencies in former days were substantial if they were not good. Spain drew tribute directly from her dependencies. England thought she drew it indirectly through her commercial system. It was also felt that the military resources of the colonies were at the command of the mother-country. When the commercial system was relinquished, and when self-government transferred to the colonies the control of their own resources, the financial and military motives ceased to exist. But the conservative imagination supplied their place with the notion of political tutelage, feigning—though, as we have seen, against all the evidence of history—that the colony, during the early stages of its existence, needed the political guidance of the mother-country in order to fit it to become a nation. Such was the language of colonial statesmen generally till the present conservative reaction again brought into fashion something like the old notion of aggrandizement, though for tribute and military contingents, the solid objects of the old policy, is now substituted "prestige." That the political connection between England and Canada is a source of military security to either, nobody, we apprehend, maintains. The only vulnerable point which England presents to the United States is the defenseless frontier of Canada; the only danger to which Canada is exposed is that of being involved in a quarrel between the aristocracy of England and the democracy of the United States. Defenseless, it is believed, the frontier of Upper Canada has been officially pronounced to be, and the chances of a desperate resistance to the invader in the French province can scarcely be rated very high. It is said that the British fleet would bombard New York. If Canada were in the hands of the enemy, the bombardment of New York would hardly alleviate her condition. But the bombardment of New York might not be an easy matter. The force of floating coast-defenses seems now to be growing superior to that of ocean-going navies. Besides, America would choose the moment when England was at war with some other naval power. Soldiers and sailors, and of the best quality, England might no doubt find in Canada; but she would have to pay for them more than she pays for soldiers and sailors re-

cruited at home. Whether morality is embodied in Bismarck or not, modern policy is; and Bismarck seems not to covet distant dependencies; he prefers solid and concentrated power.

"Commerce follows the flag," is a saying which it seems can still be repeated by a statesman; but, like the notion that dependencies are a source of military strength, it is a mere survival from a departed system. Commerce followed the flag when the flag was that of a power which enforced exclusive trading. But exclusive trading has given way, as an imperial principle, to free-trade, and the colonies, in the exercise of their fiscal power of self-government, have dissolved the commercial unity of the empire. They frame their independent tariffs, laying, in some cases, heavy duties on English goods. It will hardly be contended that, apart from commercial legislation, colonial purchasers inquire whether goods were produced under the British flag. "The best customer," says Sir George Lewis, "which a nation can have, is a thriving and industrious community, whether it be dependent or independent. The trade between England and the United States is probably far more profitable to the mother-country than it would have been if they had remained in a state of dependence upon her." As to Canada, what she needs, and needs most urgently, is free access to the market of her own continent, from which, as a dependency of England, she is excluded by the customs-line. With free access to the market of her own continent, she might become a great manufacturing country; but manufactures are now highly specialized, and to produce with advantage you must produce on a large scale. Nor is the evil confined to manufactures; the farm-products of Canada are depreciated by exclusion from their natural market, and the lumber-trade, which is her great industry, will be in serious jeopardy, since, by the fall of wages in the States, the production of lumber there has been rendered nearly as cheap as it is in Canada, while Canadian lumber is subject to a heavy duty. The projects for opening markets in Australia merely serve to show how severely Canada feels the want of a market close at hand. Cut off any belt of territory commercially from the continent to which it belongs, industry will be stunted, the inflow of capital will be checked, and impoverishment will follow isolation. The Canadians will find this out in time, and the discovery will be the first step toward a change of system.

It is true that Canada has drawn a good deal of British capital into works little remunerative to the investors, though, perhaps, not more than the United States and other countries with which there was no political connection. But, if we consider credit as well as cash, the gain must be pronounced doubtful, and it is balanced by such a work as the Intercolonial Railway, into which Canada has been led by imperial influence, and which, after costing more than four millions sterling, will, as some leading Canadian men of business think, hardly "pay for the grease upon the wheels." The Pacific Railway, and the indemnity which Canada is forced to pay to British Columbia for the non-performance of an impracticable treaty, are too likely, in the opinion of many, to furnish another illustration of the expensiveness of the imperial connection.

That emigration is favorably influenced by political dependency is another lingering belief which seems now to have no foundation in fact, though it had in the days when emigration was a government affair. The stream of emigration, in ordinary times, sets, as has often been proved, not toward Canada, but toward the United States; and of the emigrants who land in Canada a large proportion afterward pass the line, while there is a constant exodus of French-Canadians from their own poor and overpeopled country (overpeopled so long as it is merely agricultural) to the thriving industries and high wages of the States. Emigrants, whose object is to improve their material condition, are probably little influenced by political considerations; they go to the country which offers the best openings and the highest wages; but English peasants and artisans would be likely, if anything, to prefer the social elevation promised them in a land of equality to anything like a repetition of the social subjection in which they have lived at home, while by the Irishman escape from British rule is deemed escape from oppression.

Whether the tutelage of the mother-country has ever been useful to a colony, even in its infancy, except where there was actual need of military protection, is a question to which the language of the adherents of the colonial system themselves, when reviewing the history of colonial government, seems to suggest a negative reply. "Hitherto," says Mr. Roebuck, "those of our possessions termed colonies have not been governed according to any settled rule or plan. Caprice and chance have decided generally everything connected with them; and if success has in any case attended the attempts of the English people to establish colonies, that success has been obtained in spite of the mischevious intermeddling

of the English Government, not in consequence of its wise and provident assistance." Such is the refrain of almost all the works on the colonies, whether they treat of the general administration or of some special question, such as that of the crown-lands, which appears to have been solved by Downing Street in various ways, but always wrong. Not by government, but by fugitives from the tyranny of government, the great American colony was founded; unaided and unregulated it grew, and laid the deep foundations of society in the New World. With tutelage came blundering, jobbery, mischief of all kinds, and at last a violent rupture, which, injurious as it was to the mother-country, inflicted a still greater injury on the colony by launching it on the career of democracy with a violent revolutionary bias, whereas it needed a bias in favor of respect for authority. The presence of the British embassador at the Centenary was not only the ratification of the revolt, but the condemnation of the colonial system. After the American Revolution, the next step of the British Government was to divert the stream of English emigration from America—where there was abundant room for it, and whither, the pioneer work having then been done, it would have been most profitably directed—to Australia, where the pioneer work had to be done over again, measures being at the same time taken to taint the new society with convict-blood. To what good this scattering of English emigration has led, beyond the poetic conception of a boundless empire, it would seem difficult to say; and Canada, before she expresses conventional joy at the annexation of Feejee, should ask herself whether a new colony is anything more to her than a new competitor for the labor which is her prime need. In Canada herself, tutelage, while it was really exercised, led to every sort of evil. Government was jobbed by an oligarchy called the Family Compact, which Downing Street supported, not from bad motives, but from sheer ignorance of facts, till the misrule ended in the insurrection of 1837. Things have gone smoothly only since real tutelage has departed, and left nothing but an image of royalty which reigns with gracious speeches and hospitality, but does not govern. There has been no want of good intentions on the part of English statesmen, nor would it be reasonable to suppose that there has been any special want of wisdom; probably no other statesmen would have done so well; but the task imposed on them was hopeless. One tree might as well be set to regulate the growth of another tree, as one nation to regulate the growth of another nation; and in this case the two trees are of different sorts and planted under different skies.

We can imagine the single mind of a despot moulding the political character of a colony, if not well, at least with adequate knowledge, with intelligence, and upon a definite plan. But England is not a single mind. England is the vast and motley mass of voters, including, since the Conservative Reform Bill, the most uneducated populace of the towns—people who, in politics, do not know their right hand from their left, who cannot tell the name of the leader of their own party, who vote for blue or yellow, and are led by senseless local cries, by bribery, or by beer. These are the political tutors of Canada, a country in which both wealth and education are more diffused than they are here. How much does the average Englishman, or even the educated Englishman, know about Canadian politics? As much as Canadians know about the politics of Tasmania or the Cape. In "Phineas Finn," the hero of the tale, being under-secretary for the colonies, goes on a message to Marylebone "to find what the people there think about the Canadas." His report is: "Not one man in a thousand cares whether the Canadians prosper or fail to prosper. They care that Canada should not go to the States, because, though they don't love the Canadians, they do hate the Americans. That's about the feeling in Marylebone, and it's astonishing how like the Maryleboners are to the rest of the world." It will hardly be said that this is an unfair picture of a Londoner's normal frame of mind with regard to Canadian questions, or that Dorsetshire and Tipperary are better informed than London. When did a Canadian question influence an English election? How often is Canada mentioned in an election-address? Canadian journals are never tired of exposing what they deem the scandalous ignorance of the leading journals of England on Canadian subjects, but they fail to draw the obvious moral. If the *Times* blunders, are the leaders of English opinion generally, and their constituents, likely to be better instructed and to decide aright? Burke, writing of the American Revolution, said that he could trace all the mischief "to the single source of not having had steadily before our eyes a general, comprehensive, and well-proportioned view of the whole of our dominions, and a just sense of their true bearings and relations." To say nothing of the ordinary holders of political power, in how many English statesmen, occupied as English statesmen are with home questions and party struggles, would Burke have found this

comprehensive view, or the knowledge necessary for the formation of it? The colonial secretary himself is as often as not a man personally unacquainted with the colonies, not called to his post by special aptitude, but placed in it by party convenience. He must often depend for his information on such colonists as may find special access to Downing Street, or on the reports of governors, who, being images of royalty, are apt, like royalty, to be screened from truth. A peer he may be, but his peerage will not make him a Providence. The annexation of Manitoba and of British Columbia to Canada—with which the latter, at all events, has no geographical connection—is by some thought to have been a disastrous, by all allowed to have been a most critical, step: it was taken under the auspices of the late Lord Lytton, a brilliant and prolific novelist, brought into the government to make set speeches.

If any one supposes that the retention in Canada of the forms of monarchy excludes or mitigates any of the political evils, or even the coarseness to which democracy is liable in its crude condition, a year's residence in the country, a month's perusal of the party newspapers, or an hour's conversation with any Canadian man of business who has watched politics without taking part in them, will probably settle his opinion on that subject. That monarchical forms are no safeguard against corruption is a fact of which, unhappily, the colony has of late years had decisive proof. If the inquirer wishes to enlarge the basis of his induction, let him go through a file of Australian journals: he will there find a picture of public life, public character, and senatorial manners, decidedly below the level of the better States of the Union. Canada has escaped the elective judiciary, but so has Massachusetts; and both that and the removable civil service were the work not of real Republicans, but of the Democratic party—that is, of the slave-owning oligarchy of the South using as its instruments the Northern mob. Her exemption from the civil war and its fiscal consequences, Canada owes merely to her separation from the States; it would have been the same had she been an independent nation. Had the political connection with Great Britain never existed, and had the weight of Canada been early thrown into the scale of freedom, there might have been no civil war.

In the case of the Pacific Railway scandal, the Governor-General may be said to have formally avowed himself a *fainéant*. He decided that he was absolutely bound to follow the advice of his ministers, even when those ministers lay under the heaviest charges of corruption, and even as to the mode in which the investigation into those charges should be conducted; and his conduct was approved by the home Government. He has, therefore, no authority, and of nothing, nothing comes.

Most readers of the *Fortnightly* are probably prepared to regard with tolerance the proposition that figments and hypocrisies do no more good in politics than they do in general life. In Canadian politics they do much evil by blinding public men and the people generally to the real requirements of the situation. The hereditary principle was dead at its root; its work was done, and its age had passed away in the more advanced portion of humanity when the communities of the New World were founded. It lingers on, as things do linger on, in its native soil; but it can furnish no sound basis for government in the soil of reason and equality. The only conceivable basis for government in the New World is the national will; and the political problem of the New World is how to build a strong, stable, enlightened, and impartial government on that foundation. That it is a very difficult problem, daily experience in Canada, as well as in the neighboring republic, shows, and to be successfully resolved it must be seen in its true bearings, which the ostensible retention of the hereditary principle as the security for good and stable government obscures. Canada, though adorned with the paraphernalia of eight constitutional monarchies (one central and seven provincial), is a democracy of the most pronounced kind; the Governor-General was not wrong in saying that she is more democratic than the United States, where the President is an elective king, and where the Senate, which though elective is conservative, possesses great power, whereas the nominated Senate of Canada is a cipher. Demagogism and the other pests of democratic institutions are not to be conjured away by forms and phrases; they can be repressed and prevented from ruining the state only by developing remedial forces of a really effective kind, and by adjusting the actual machinery of the constitution so as to meet the dangers which experience may reveal. The treason-law of the Plantagenets with which, as well as with the Lord-Chamberlain's code of precedence, Canada is endowed, is not of much use to her while she is left without any legal means of repressing her real cancer, political corruption. Loyalty to the *fainéant* deputy of a distant crown may be in a certain sense real; it may be felt by

those who profess it; but it probably does not often prompt to a good political action, and it certainly never restrains from a bad one. Among Canadians, as among American politicians, the most "truly loyal" are often the most unscrupulous and corrupt. They are often, through the whole course of their public lives, disloyal to everything that represents public honor and the public good. A provincial court adds flunkeyism to demagogism without making the demagogue less profligate, less dangerous, or less vile. It does not even make him less coarse. No refining influence can really be exercised by a few dinners and receptions even over the small circle which attends them; while the social expenditure and display which are imposed on the Governor-General as the condition of his popularity in the colony, and of the maintenance of his reputation at home, are anything but a wholesome example for colonial society, which on the contrary needs an example of hospitality and social enjoyment cultivated in an easy and inexpensive way.

At present the bane of Canada is party government without any question on which parties can be rationally or morally based. The last question of sufficient importance to form a rational and moral basis for a party was that of the Clergy Reserves and the Church Establishment, since the settlement of which there has been absolutely no dividing line between the parties or assignable ground for their existence, and they have become mere factions, striving to engross the prizes of office by the means which faction everywhere employs. The consequences are the increasing ascendency of the worst men, and the political demoralization of a community, which, if a fair chance were given it, would furnish as sound a basis for good government as any community in the world. Of course, England cannot be charged with introducing the party system into Canada; but she does fling over it the glamour of British association, and beguile a country really abandoned to all the instability and all the degrading influences of government by faction with the ostensible stability and dignity of the hereditary crown. Indeed, the provision in the draught of confederation that both the parties should be considered in the first nomination of senators is, perhaps, the only authoritative recognition which the party system has ever received. In common with the other colonies, Canada is deemed happy in being endowed with a counterpart of the British Constitution. The British Constitution, putting aside the legal forms and phrases, is government by party; and whatever government by party may be in England, where there are some party questions left, in Canada it is a most noxious absurdity, and is ruining the political character of the people.

When Canadian Nationalists say that patriotism is a good thing, they are told to keep their wisdom for the copy-books; and the rebuke would be just if those who administer it would recognize the equally obvious truth that there can be no patriotism without nationality. In a dependency there is no love of the country, no pride in the country; if an appeal is made to the name of the country, no heart responds as the heart of an Englishman responds when an appeal is made to the name of England. In a dependency every bond is stronger than that of country, every interest prevails over that of the country. The province, the sect, Orangism, Fenianism, Freemasonry, Odd-Fellowship, are more to the ordinary Canadian than Canada. So it must be while the only antidote to sectionalism in a population with strongly-marked differences of race and creed is the sentiment of allegiance to a distant throne. The young Canadian leaving his native country to seek his fortune in the States feels no greater wrench than a young Englishman would feel in leaving his county to seek his fortune in London. Want of nationality is attended, too, with a certain want of self-respect, not only political but social, as writers on colonial society and character have observed. Wealthy men in a dependency are inclined to look to the imperial country as their social centre and the goal of their social ambition, if not as their ultimate abode, and not only their patriotic munificence but their political and social services are withdrawn from the country of their birth.

Mr. Trollope finds himself compelled to confess that in passing from the United States into Canada you pass "from a richer country into one that is poorer, from a greater country into one that is less." You pass from a country embracing in itself the resources of a continent, into one which is a narrow section of that continent cut off commercially from the rest; you pass from a country which is a nation into a country which is not a nation.

On the other hand, there were reasons which, not only to patriotic Canadians, but to patriotic Americans, if they took a comprehensive view of the interests of their country, seemed strong for wishing that Canada should remain politically separate from the United States. Democracy is a great experiment, which might be more safely carried on by two nations than by one. By emu-

lation, mutual warning and correction, mutual supplementation of defects, they might have helped each other in the race and steadied each other's steps; a balance of opinion might have been established on the continent, though a balance of power cannot; and the wave of dominant sentiment which spreads over that vast democracy like the tide running in over a flat, might have been usefully restricted in its sweep by the dividing line. Nor was there any insurmountable obstacle in the way. Canada is wanting in unity of race; but not more so than Switzerland, whose three races have been thoroughly welded together by the force of nationality. She is wanting in compactness of territory, but not more so, perhaps, than some other nations—Prussia, for instance—have been. In this latter respect, however, the situation has been seriously altered by the annexation of Manitoba and British Columbia, which in their present raw condition have no influence beyond that of distant possessions, but which, when peopled and awakened to commercial life, will be almost irresistibly attracted by the economical forces to the States which adjoin them on the south, and will thus endanger the cohesion of the whole confederacy. The very form of the Dominion indeed, drawn out and attenuated as it is by these unnatural additions, apart from the attractive influence of Minnesota and California, would seriously imperil its political unity, as will be seen, if, instead of taking Canada as it is presented by the political map, the boundary-line is drawn between the habitable portion and that which belongs only to arctic frosts. In the debate on confederation it was urged by the advocates of the measure that seven sticks, though separately weak, when bound together in a fagot would be strong. "Yes," was the reply, "but not so seven fishing-rods tied together by the ends."

As to the expense of a national government, it would probably not be greater than that of the governor-generalship and the seven lieutenant-governorships is at present. Diplomacy in these days of rapid communication may be cheaply done, and Canada would not need much of it: she has no Eastern question.

The question of military security has reference solely to the danger to be apprehended on the side of the United States; and danger on the side of the United States, supposing Canada disentangled from English quarrels, we believe that there is none. The Americans, as has been repeatedly observed, have since the fall of slavery given every proof of an unambitious disposition. They disbanded their vast armaments immediately on the close of the civil war, without waiting even for the Alabama question to be settled; they have refused to annex St. Domingo; they have observed a policy of strict non-intervention in the case of Cuba, which they might have made their own with the greatest ease; they have declined to take advantage of the pretexts furnished them in abundance, by border outrages, of conquering Mexico; it is very doubtful whether they would even have purchased Alaska, if Mr. Seward had not drawn them by secret negotiations into a position from which they could not well retreat. Slavery wanted conquest for the creation of new slave States, but with slavery the spirit of aggression appears to have died. Welcome Canada into the Union, if she came of her own accord, the Americans no doubt would. They would be strangely wanting in wisdom if they did not; for she would bring them as her dower not only complete immunity from attack and great economical advantages, but a political accession of the most valuable kind in the shape of a population, not like that of St. Domingo, Cuba, or Mexico, but trained to self-government, and capable of lending fresh strength and vitality to republican institutions. It is true that, slavery having been abolished, the urgent need of adding to the number of the free States in order to counterbalance the extension of slavery in the councils of the Union no longer exists; but there are still in the population of the United States large elements essentially non-republican — the Irish, the emigrants from Southern Germany, the negroes—to which, perhaps, may be added a considerable portion of Southern society itself, which can hardly fail to retain something of its old character while it continues to be composed of a superior and inferior race. Against these non-republican elements, the really republican element still needs to be fortified by all the reënforcements which it can obtain. Welcome Canada, therefore, into the Union the Americans no doubt would. But that they have the slightest inclination to lay violent hands upon her, that such a thought ever enters their minds, no one who has lived among them, and heard the daily utterances of a by no means reticent people, can believe. Apart from moral principle, they know that, though a despotic government may simply annex, a republic must incorporate, and that to incorporate four millions of unwilling citizens would be to introduce into the republic a most dangerous mass of disaffection and disunion. That the Americans have been litigious in their

dealings with Canada is true; but litigiousness is not piracy; and, as we have already said, the real object of their irritation has not been Canada, but England. The Monroe doctrine was held by Canning as well as by Monroe; and, irrespectively of any desire of aggrandizement, the intrusion of an American power here would probably give as much umbrage to England as the intrusion of the English power in their own continent gives to the people of the United States. That the Americans would feel pride in behaving generously toward a weaker state, will appear credible only to those who have seen enough of them to know that, though supposed to care for nothing but the dollar, they have in reality a good deal of pride.

As an independent nation, Canada would, of course, be at liberty to negotiate freely for the removal of the customs-line between herself and the United States, and for her admission to all the commercial advantages of her own continent At present not only is she trammeled by imperial considerations, but it can hardly be expected that the American Government will place itself on a lower international level than that of England by treating with a dependency as a nation, especially as there are constant intimations that the dependency is retained and is being nursed up with the view of making it a rival power to the United States, and thus introducing into the continent the germs of future jealousy, and possibly of war.

That Canada can ever be made a rival power to the United States—that, if she is only kept long enough in a state of dependence, there will be an indefinite increase of her population and her strength—seems to be little better than a rhetorical fancy. The barrier of slavery being removed, the set of population is likely to be, not toward the frozen north, where the winter, besides suspending labor and business, eats up the produce of the summer in the cost of fuel, but toward those countries in which warmth is provided by the sun, and work may be carried on during the whole year. The notion that the north is the natural seat of empire seems to have no more solid foundation. It is apparently a loose generalization from the success of the northern tribes which conquered the Roman Empire. It is forgotten that those northern warriors had not only been hardened by exposure to the full severity of the northern climate, but picked by the most rigorous process of natural selection. Stove-heat is not less enervating than the heat of the sun. But a nation Canada, so far as we can see, might have been, had the attempt been vigorously made at the propitious moment, when, owing to the effects of the civil war in the United States, the balance of prosperity was decidedly in her favor, when her financial condition appeared immensely superior to that of her neighbor, and when the spirit of her people had been stirred by confederation. That opportunity was allowed to pass, and, in all probability, it will never return.

A movement in favor of nationality there was—one which had a twofold claim to sympathy, because it was also a movement against faction and corruption, and which, though it has failed, has left honorable traces on public life. But it was not strong enough to make head against the influences which have their centre in the little court of Ottawa, and the attacks of the lower class of politicians, who assailed it with the utmost ferocity, seeing clearly that the success of the higher impulse would not suit their game. Moreover, the French province interposed between the British provinces of the east and west, is a complete non-conductor, and prevents any pulsation from running through the whole body. It must further be owned that, in industrial communities, the economical motives are stronger than the political, and that the movement in favor of Canadian nationality had only political motives on its side. Perhaps the appearance of a great man might after all have turned the scale; but dependencies seldom produce great men.

Had the movement in favor of nationality succeeded, the first step would have been a legislative union, which would in time have quelled sectionalism, and made up for the deficiency of material size and force by moral solidity and unity of spirit. Canada, as was said before, is hardly a proper subject for federal government, which requires a more numerous group of states and greater equality between them. Confederation as it exists, we repeat, has done little more than develop the bad side of democratic government. A project is now on foot for a legislative union between Nova Scotia, New Brunswick, and Prince Edward's Island; but this will only make matters worse by reducing the number of important states to three (Manitoba and British Columbia being in the merest infancy), two of which will be always combining against the third. That there would have been opposition to a legislative union of the whole of Canada on the part of Quebec is more than probable; but Quebec, if she had been handled with determination, would most likely have given way.

Canadian nationality being a lost cause, the ultimate union of Canada with the United States appears now to be morally certain; so that nothing is left for Canadian patriotism but to provide that it shall be a union indeed, and not an annexation; an equal and honorable alliance like that of Scotland and England, not a submission of the weaker to the stronger; and at the same time that the political change shall involve no change of any other kind in the relations of Canada with her mother-country. The filaments of union are spreading daily, though they may be more visible to the eye of one who sees Canada at intervals than to that of a constant resident. Intercourse is being increased by the extension of railways; the ownership and management of the railways themselves are forming an American interest in Canada; New York is becoming the pleasure, and, to some extent, even the business, capital of Canadians; American watering-places are becoming their summer resort; the periodical literature of the States, which is conducted with extraordinary spirit and ability, is extending its circulation on the northern side of the line; and the Canadians who settle in the States are multiplying the links of family connection between the two countries. To specify the time at which a political event will take place is hardly ever possible, however assured the event itself may be; and in the present instance the occurrence depends not only on the circumstances of Canada, where, as we have seen, there is a great complication of secondary forces, but on the circumstances of the United States. If the commercial depression which at present prevails in Canada continues or recurs, if Canadian manufactures are seen to be dying under the pressure of the customs-line; if, owing to the depression or to over-costly undertakings, such as the Pacific Railway, financial difficulties arise; if, meantime, the balance of prosperity, which is now turning, shall have turned decisively in favor of the United States, and the reduction of their debt shall have continued at the present rate—the critical moment may arrive, and the politicians, recognizing the voice of Destiny, may pass in a body to the side of continental union. It will be fortunate if a misunderstanding between the Canadian Government and Downing Street, about some question such as that respecting the pecuniary claims of British Columbia, which is now assuming such exaggerated proportions, does not supervene to make the final dissolution of the political tie a quarrel instead of an amicable separation.

To Canada the economical advantages of continental union will be immense; to the United States its general advantages will be not less so. To England it will be no menace, but the reverse: it will be the introduction into the councils of the United States, on all questions, commercial as well as diplomatic, of an element friendly to England, the influence of which will be worth far more to her than the faint and invidious chance of building up Canada as a rival to the United States. In case of war, her greatest danger will be removed. She will lose neither wealth nor strength; probably she will gain a good deal of both. As to glory, we cannot do better than quote in conclusion the words of Palmerston's favorite colleague, and the man to whom he, as was generally supposed, wished to bequeath his power:

"There are supposed advantages flowing from the possession of dependencies, which are expressed in terms so general and vague that they cannot be referred to any determinate head. Such, for example, is the glory which a country is supposed to derive from an extensive colonial empire. We will merely remark, upon this imagined advantage, that a nation derives no true glory from any possession which produces no assignable advantage to itself or to other communities. If a country possesses a dependency from which it derives no public revenue, no military or naval strength, and no commercial advantages or facilities for emigration, which it would not equally enjoy though the dependency were independent, and if, moreover, the dependency suffers the evils which (as we shall show hereafter) are the almost inevitable consequences of its political condition, such a possession cannot justly be called glorious."

—*The Fortnightly Review.*

THEOLOGICAL LIBRARY

"CRAM."

By Prof. W. STANLEY JEVONS.

A HUMAN institution has, like man, its seven ages. In its infancy, unknown and unnoticed, it excites in youth some interest and surprise. Advancing toward manhood, every one is forward in praising its usefulness. As it grows up and becomes established, the popular tone begins to change. Some people are unavoidably offended or actually injured by a new institution, and, as it grows older and more powerful, these people become more numerous. In proportion to the success of an undertaking will be the difficulties and jealousies which are encountered. It becomes the interest of certain persons to find out the weak points of the system, and turn them to their private advantage. Thus the institution reaches its critical age, which safely surmounted, it progresses through a prosperous middle life to a venerable old age of infirmities and abuses, dying out in the form of a mere survival.

There is no difficulty in seeing what period of life the examination-system has now reached. It is that critical age at which its progress is so marked as to raise wide-spread irritation. To abuse examinations is one of the most popular commonplaces of public speeches and after-dinner conversation. Everybody has something to say in dispraise, and the reason is pretty obvious. Many persons have been inconvenienced by examinations; some regret the loss of patronage; others the loss of patrons and appointments; schoolmasters do not like having their work rudely tested—they feel the competition of more far-sighted teachers who have adapted themselves betimes to a new state of things. In these and other ways it arises that a formidable minority actually have good grounds for hating examinations. They make their feelings widely known, and the general public, ever ready to grumble at a novelty of which they hear too much, and do not precisely appreciate the advantages, take up the burden of the complaint.

Fortunately, too, for the opponents of examination, an admirable "cry" has been found. Examination, they say, leads to "cram," and "cram" is the destruction of true study. People who know nothing else about examination know well enough that it is "cram." The word has all the attributes of a perfect *question-begging epithet*. It is short, emphatic, and happily derived from a disagreeable physical metaphor. Accordingly, there is not a respectable gentleman distributing prizes to a body of scholars at the end of the session, and at a loss for something to say, who does not think of this word "cram," and proceed to expatiate on the evils of the examination-system.

I intend in this article to take up the less popular view of the subject and say what I can in favor of examinations. I wish to analyze the meaning of the word "cram," and decide, if possible, whether it is the baneful thing that so many people say. There is no difficulty in seeing at once that "cram" means two different things, which I will call "good cram" and "bad cram." A candidate, preparing for an important competitive examination, may put himself under a tutor well skilled in preparing for that examination. This tutor looks for success by carefully directing the candidate's studies into the most "paying" lines, and restricting them rigorously to those lines. The training given may be of an arduous, thorough character, so that the faculties of the pupil are stretched and exercised to their utmost in those lines. This would be called "cram" because it involves exclusive devotion to the answering of certain examination-papers. I call it "good cram."

"Bad cram," on the other hand, consists in temporarily impressing upon the candidate's mind a collection of facts, dates, or formulæ, held in a wholly undigested state and ready to be disgorged in the examination-room by an act of mere memory. A candidate, unable to apprehend the bearing of Euclid's reasoning in the first book of his "Elements," may learn the propositions off by heart, diagrams, letters, and all, like a Sunday-scholar learning the collects and gospels. Dates, rules of grammar, and the like, may be "crammed" by mnemonic lines, or by one of those wretched systems of artificial memory, teachers of which are always going about. In such ways it is, I believe, possible to give answers which simulate knowledge, and no more prove true knowledge than the chattering of a parrot proves intellect.

I am far from denying the existence of "bad cram" of this character, but I hold that it can

never be advantageously resorted to by those who are capable of "good cram." To learn a proposition of Euclid by heart is far more laborious than for a student of moderate capacity to master the nature of the reasoning. It is obvious that all advantages, even in an examinational point of view, are on the side of real knowledge. The slightest lapse of memory in the bad "crammer"—for instance, the putting of wrong letters in the diagram—will disclose the simulated character of his work, and the least change in the conditions of the proposition set will frustrate his mnemonic devices altogether. If papers be set which really can be answered by mere memory, the badness is in the examiners.

Thorough blockheads may be driven to the worst kind of "cram," simply because they can do nothing better. Nor do the blockheads suffer harm; to exercise the memory is better than to leave the brain wholly at rest. Some qualities of endurance and resolution must be called into existence before a youth can go through the dreary work of learning off by heart things of which he has no comprehension. Nor with examiners of the least intelligence is there any reason to fear that the best-directed "bad cram" will enable a really stupid candidate to carry off honors and appointments due to others. No examination-papers, even for junior candidates, should consist entirely of "book-work," such as to be answered by the simple reproduction of the words in a text-book. In every properly-conducted examination, questions are, as a matter of course, set to test the candidate's power of applying his knowledge to cases more or less different from those described in the books. Moreover, good examiners always judge answers by their general style, as well as by their contents. It is really impossible that a stupid, slovenly candidate can, by any art of "cramming," be enabled to produce the neat, brief, pertinent essay, a page or two long, which wins marks from the admiring examiners.

If we may judge from experience, too, "bad cram" does not pay from the tutor's point of view. That this is so, we may learn from the fact that slow, ignorant pupils are ruthlessly rejected by the great "coaches." Those who have their reputation and their living to make by the success of their candidates cannot afford to waste their labor upon bad material. Thus, it is not the stupid who go to the "cramming" tutors to be forced over the heads of the clever, but it is the clever ones who go to secure the highest places. Long before the critical days of the official examination, the experienced "coach" selected his men almost as carefully as if he were making up the university boat. There is hardly a university or a college in the kingdom which imposes any selective process of the sort. An entrance or matriculation examination, if it exists at all, is little better than a sham. All comers are gladly received to give more fees and the appearance of prosperity. Thus, it too often happens that the bulk of a college class consists of untutored youths, through whose ears the learned instructions of the professor pass, harmlessly it may be, but uselessly. Parents and the public have little idea how close a resemblance there is between teaching and writing on the sands of the sea, unless either there is a distinct capacity for learning on the part of the pupil, or some system of examination and reward to force the pupil to apply.

For these and other reasons which might be urged, I do not consider it worth while to consider "bad cram" any further. I pass on to inquire whether "good cram" is an objectionable form of education. The good "cramming" tutor or lecturer is one whose object is to enable his pupils to take a high place in the list. With this object he carefully ascertains the scope of the examination, scrutinizes past papers, and estimates in every possible way the probable character of future papers. He then trains his pupils in each branch of study with an intensity proportioned to the probability that questions will be asked in that branch. It is too much to assume that this training will be superficial. On the contrary, though narrow, it will probably be intense and deep. It will usually consist, to a considerable extent, in preliminary examinations, intended both to test and train the pupil in the art of writing answers. The great "coaches" at Cambridge, in former days, might be said to proceed by a constant system of examination, oral instruction or simple reading being subordinate to the solving of innumerable problems. The main question which I have to discuss, then, resolves itself into this: Whether intense training, directed to the passing of certain defined examinations, constitutes real education. The popular opponents of "cram" imply that it does not; I maintain that it does.

It happened that, just as I was about to write this article, the Home Secretary presided at the annual prize-distribution in the Liverpool College, on the 22d of December, 1876, and took occasion to make the usual remarks about "cram." He expressed with admirable clearness the prevailing complaints against examinations, and I shall

therefore take the liberty of making his speech in some degree my text. "Examination is not education," he said; "you require a great deal more than that. As well as being examined, you must be taught. . . . In the great scramble for life, there is a notion at the present moment of getting hold of as much general superficial knowledge as you can. That, to my mind, is a fatal mistake. On the other hand, there is a great notion that if you can get through your examination, and 'cram up' a subject very well, you are being educated. That, too, is a most fatal mistake. There is nothing which would delight me so much, if I were an examiner, as to baffle all the 'cramming' teachers whose pupils came before me." (Laughter.)

Let us consider what Mr. Cross really means. Examination, he says, is not education; we require a great deal more—we must be taught as well as be examined. With equal meaning, I might say: "Beef is not dinner; we want a great deal more—we must have potatoes, bread, pudding, and the like." Nevertheless, beef is a principal part of dinner. Nobody, I should think, ever asserted or imagined that examination alone was education, but I nevertheless hold that it is one of the chief elements of an effective education. As Mr. Cross himself said, in an earlier part of his speech: "The examination is a touchstone and test which shows the broad distinction between good and bad. . . . You may manage to scramble through your lessons in the 'half,' but I will defy you to get through your examinations if you do not know the subjects."

Another remark of Mr. Cross leads me to the main point of the subject. He said: "It is quite necessary in the matter of teaching that whatever is taught must be taught well, and nothing that is taught well can be taught in a hurry. It must be taught not simply for the examination, but it must sink into your minds, and stay there for life."

Both in this and his other remarks, Mr. Cross commits himself to the popular but wholly erroneous notion that what boys learn at school and college should be useful knowledge indelibly impressed upon the mind, so as to stay there all their lives, and be ready at their fingers' ends. The real point of the objections to examination commonly is, that the candidate learns things for the examination only, which, when it is safely passed, he forgets again as speedily as possible. Mr. Cross would teach so deliberately and thoroughly that the very facts taught could not be forgotten, but must ever after crop up in the mind whatever we are doing.

I hold that remarks such as these proceed from a wholly false view of the nature and purposes of education. It is implied that the mind in early life is to be stored with the identical facts and bits of knowledge which are to be used in after-life. It is, in fact, Mr. Cross and those who think with him who advocate a kind of "cram," enduring it is true, but still "bad cram." The true view of education, on the contrary, is to regard it as a course of training. The youth in a gymnasium practises upon the horizontal bar, in order to develop his muscular powers generally; he does not intend to go on posturing upon horizontal bars all through life. School is a place where the mental fibres are to be exercised, trained, expanded, developed, and strengthened, not "crammed" or loaded with "useful knowledge."

The whole of a youth's subsequent career is one long course of technical "cramming" in which any quantity of useful facts are supplied to him *nolens volens*. The merchant gets his technical knowledge at the clerk's desk, the barrister in the conveyancer's offices or the law courts, the engineer in the workshop and the field. It is the very purpose of a *liberal education*, as it is correctly called, to develop and train the plastic fibres of the youthful brain, so as to prevent them taking too early a definite "set," which will afterward narrow and restrict the range of acquisition and judgment. I will even go so far as to say that it is hardly desirable for the actual things taught at school to stay in the mind for life. The source of error is the failure to distinguish between the *form* and the *matter* of knowledge, between the facts themselves and the manner in which the mental powers deal with facts.

It is wonderful that Mr. Cross and those who moralize in his strain do not perceive that the actual facts which a man deals with in life are infinite in number, and cannot be remembered in a finite brain. The psychologists, too, seem to me to be at fault in this matter, for they have not sufficiently drawn attention to the varying degrees of duration required in a well-organized memory. We commonly use the word memory so as to cover the faculties of retention, reproduction, and representation, as described by Hamilton, and very little consideration will show that in different cases we need the powers of retention, of suggestion, and of imagination, in very different degrees. In some cases we require to remember a thing only a few moments, or a few minutes; in other cases a few hours or days; in

yet other cases a few weeks or months: it is an infinitesimally small part of all our mental impressions which can be profitably remembered for years. Memory may be too retentive, and facility of forgetting and of driving out one train of ideas by a new train is almost as essential to a well-trained intellect as facility of retention.

Take the case of a barrister in full practice, who deals with several cases in a day. His business is to acquire as rapidly as possible the facts of the case immediately before him. With the powers of representation of a well-trained mind he holds these facts steadily before him, comparing them with each other, discovering their relations, applying to them the principles and rules of law more deeply graven on his memory, or bringing them into connection with a few of the more prominent facts of previous cases which he happens to remember. For the details of laws and precedents he trusts to his text-writers, the statute-book, and his law-library. Even before the case is finished his mind has probably sifted out the facts and rejected the unimportant ones by the law of obliviscence. One case done with, he takes up a wholly new series of facts, and so from day to day, and from month to month, the matter before him is constantly changing. The same remarks are even more true of a busy and able administrator like Mr. Cross. The points which come before him are infinite in variety. The facts of each case are rapidly brought to his notice by subordinates, by correspondents, by debates in the House, by deputations and interviews, or by newspaper reports. Applying well-trained powers of judgment to the matter in hand, he makes a rapid decision and passes to the next piece of business. It would be fatal to Mr. Cross if he were to allow things to sink deep into his mind and stay there. There would be no difficulty in showing that in like manner, but in varying degrees, the engineer, the physician, the merchant, even the tradesman or the intelligent artisan, deals every day with various combinations of facts which cannot all be stored up in the cerebral framework, and certainly need not be so.

The bearing of these considerations upon the subject of examinations ought to be very evident. For what is "cram" but the rapid acquisition of a series of facts, the vigorous getting up of a case, in order to exhibit well-trained powers of comprehension, of judgment, and of retention, before an examiner? The practised barrister "crams" up his "brief" (so called because, as some suppose, made *brief* for the purpose), and stands an examination in it before a judge and jury. The candidate is not so hurried; he spends months, or it may be two or three years, in getting up his differential calculus, or his inorganic chemistry. It is quite likely that when the ordeal is passed, and the favorable verdict delivered, he will dismiss the equations, and the salts, and the compounds, from his mind as rapidly as possible; but it does not follow that the useful effect of his training vanishes at the same time. If so, it follows that almost all the most able and successful men of the present day threw away their pains at school and college. I suppose that no one ever heard of a differential equation solving a nice point of law, nor is it common to hear Sophocles and Tacitus quoted by a leading counsel. Yet it can hardly be denied that our greatest barristers and judges were trained in the mathematical sciences, or, if not, that their teachers thought the classics a better training-ground. If things taught at school and college are to stay in the mind to serve us in the business of life, then almost all the higher education yet given in this kingdom has missed its mark.

I come to the conclusion, then, that well-ordered education is a severe system of well-sustained "cram." Mr. Herbert Spencer holds that the child's play simulates the actions and exercises of the man. So I would hold that the agony of the examination-room is an anticipation of the struggles of life. All life is a long series of competitive examinations. The barrister before the jury; the preacher in his pulpit; the merchant on the Exchange-flags; the member in the House —all are going in for their "little goes," and their "great goes," and their "triposes." And I unhesitatingly assert that, as far as experience can guide us, or any kind of reasoning enable us to infer, well-conducted competitive examinations before able examiners are the best means of training and the best method of selection for those who are to be foremost in the battle of life.

I will go a step further, and assert that examination in one form or another is not only an indispensable test of results, but it is a main element in training. It represents the active use of faculties as contrasted with that passive use which too often resolves itself into letting things come in at one ear and go out at the other. Those who discuss examinations in the public papers seem to think that they are held occasionally and for the sole purpose of awarding prizes and appointments. But in every well-ordered course of instruction there ought to be, and there usually are, frequent less formal examinations of which outsiders hear nothing. The purposes of these

examinations are manifold: they test the progress of the class, and enable the teacher to judge whether he is pursuing a right course at a right speed; they excite emulation in the active and able; they touch the pride even of those who do not love knowledge much, but still do not like to write themselves down absolute blockheads; and they are in themselves an exercise in English composition, in the control of the thoughts, and the useful employment of knowledge. In direct educational effect a written examination may be worth half a dozen lectures. Mr. Cross says that examination is not education; I say that it is. Of course, you cannot examine upon nothing, just as you cannot grind flour in a mill unless you put the grain in. Nevertheless, examination in some form or other represents the really active grinding process in the pupil's mind.

It is not merely that which goes into the eyes and ears of a student which educates him; it is that which comes out. A student may sit on the lecture-room benches and hear every word the teacher utters; but he may carry away as much useful effect as the drowsy auditor of a curate's sermon. To instruct a youth in gymnastics, you do not merely explain orally that he is to climb up one pole, and come down another, and leap over a third. You make him do these motions over and over again, and the education is in the exertion. So intellectual education is measured not by words heard or read, but by thoughts excited. In some subjects mental exertion in the pupil is called forth by the working of problems and exercises. These form a kind of continuous examination, which should accompany every lecture. Arithmetic is only to be learned by sums upon the schoolboy's slate, and it is the infinite variety of mathematical tasks, from common addition upward, which makes mathematical science the most powerful training-ground of the intellect. The late Prof. De Morgan was probably the greatest teacher of mathematics who ever lived. He considered it requisite that students should attend his expository lectures for an hour and a quarter every day; but he always gave an abundance of exercises as well, which, if fully worked out, would take at least as long, and often twice as long, a time. Exercises are the sheet-anchor of the teacher, and in this way only can we explain the extraordinary propensity of classical teachers toward Latin verses. As I have heard such teachers explain, verses though useless in every other way afford a definite measurable amount of exercise—a manageable classical treadmill. For many years past it was my duty to teach several subjects — logic, mental and moral philosophy, and political economy. Experience made me acutely aware of the very different educational values of these diverse subjects. Logic is by far the best, because when properly taught it admits of the same active training by exercises and problems that we find im mathematics. It is no doubt necessary that some instruction should also be given to senior students in philosophy and political economy; but it is difficult in these subjects to make the student think for himself. Examination, then, represents the active as opposed to the passive part of education, and, in answer to Mr. Cross's statement that examination is not education, I venture to repeat that, in some form or other, examination is the most powerful and essential means of training the intellect.

I now pass on to the wholly different question whether open competitive examinations are the best means of selecting men for important appointments. In this view of examinations the educational results are merely incidental, and the main object is to find an impartial mode of putting the right man into the right place, and thus avoiding the nepotism and corruption which are almost inseparable from other methods of appointment. At first sight it might seem absurd to put a man in a position requiring judgment and tact and knowledge of the world because he answers rightly a few questions about mathematics and Greek. The head-master of a great school succeeds not by the teaching of the higher forms, but by the general vigor and discretion of his management. He is an administrator, not a pedagogue; then why choose a high wrangler, because of his command over differential equations? Why make a young man a magistrate in Bengal, because of his creditable translations from the classics, or his knowledge of English history? Would it not be far better to select men directly for any success which they have shown in the management of business exactly analogous to that they will have to perform?

Experience must decide in such matters, and it seems to decide conclusively in favor of examinations. Public opinion and practice, at any rate, are in favor of this conclusion. For a long time back the honors' degrees of Oxford and Cambridge have been employed as a means of selection. It does not, of course, follow that a high wrangler, or a double first, will suit every important position; but it is almost always expected nowadays that a man applying for a high post shall have some high degree. Even those

who are unfettered in their powers of appointment will seldom now appoint a young man to a conspicuous post unless his degree will justify the appointment in the eyes of the public. The President of the Council, for instance, is unrestricted in the choice of school-inspectors, but he practically makes a high degree a *sine qua non*. Not only does he thus lessen his responsibility very greatly, and almost entirely avoid suspicion of undue influence, but the general success and ability of those appointed in this manner fully bear out the wisdom of the practice.

The fact seems to be, that the powers which enable a man to take a conspicuous place in a fierce competitive examination are closely correlated, if they be not identical, with those leading to success in the battle of life. It might be expected that a high wrangler, or a double first, would generally be a weakly bookworm, prematurely exhausted by intense study, unable to expand his mind beyond his books, and deficient in all the tact and worldly knowledge to be acquired by mixing in the business of life. But experience seems to negative such ideas. The weakly men are weeded out before they get to the final struggle, or break down in the course of it. The true bookworm shows himself to be a bookworm, and does not fight his way to a high place. Success in a severe examination requires, as a general rule, a combination of robust physical health, good nerve, great general energy, and powers of endurance and perseverance, added to pure intellectual ability. There are, of course, exceptions in all matters of this sort, but, so far as we can lay down rules in human affairs, it is the *mens sana in corpore sano* which carries a candidate to the higher part of the list.

A man must not always be set down as a blockhead because he cannot stand the examination-room. Some men of extensive knowledge and much intelligence lose their presence of mind altogether when they see the dreadful paper. They cannot command their thoughts during the few hours when their success in life is at stake. The man who trembles at the sight of the paper is probably defective in the nerve and moral courage so often needed in the business of life. It by no means follows, again, that the man of real genius will take a conspicuous place in the list. His peculiar abilities will often lie in a narrow line, and be correlated with weakness in other directions. His powers can only be rendered patent in the course of time. It is well known that some of the most original mathematicians were not senior wranglers. Public examinations must be looked upon as tests of general rather than special abilities; talent, strength, and soundness of constitution win the high place —powers which can be developed in any direction in after-life.

If evidence were needed to support this view of the matter, it is amply afforded by the recent parliamentary report on the education and training of candidates for the Indian Civil Service. Whatever may be thought as to the details of the methods of training, which have been recently modified, there can be no doubt that this report is conclusive as to the success of examinational selection. The ability of the statements furnished to this report, by officers appointed by open competition, goes far to prove the success of the system. It is impossible to imagine a severer test than that system has passed through in the case of the Indian Civil Service. Young men selected for the amount of Latin, Greek, mathematics, French, German, logic, political economy, etc., which they could "cram up," have been sent out at twenty-one or twenty-three years of age, and thrown at once into a new world, where it is difficult to imagine that their "crammed" knowledge could be of the least direct use. There they have been brought into contact with a large body of older officers, appointed under a different system, and little prejudiced in favor of these "Competition Wallahs." Yet the evidence is overwhelming to the effect that these victims of "cram" have been successful in governing India. A large number of the best appointments have already been secured by them, although the system has only been in existence for twenty-two years, and seniority is naturally of much account. The number who are failures is very small, certainly smaller than it would be under the patronage system. It is impossible that I should, within the limits of this article, present the evidence accumulated on this subject. I must refer the reader to the "Blue-book" itself, which is full of interest for all concerned in education.[1] I must also refer the reader to the remarkably able essays on the subject, published by Mr. Alfred Cotterell Tupp, B. A., of the Bengal Civil Service,[2] to which essays I am indebted for some of my ideas on this subject. Mr. Tupp gives a powerful answer to the celebrated attack on the competitive system contained in the *Edinburgh Review*

[1] The Selection and Training of Candidates for the Indian Civil Service (C. 1,446). 1876. Price 3*s*. 5*d*.

[2] The Indian Civil Service and the Competitive System, a Discussion on the Examinations and the Training in England. London: R. W. Brydges, 137 Gower Street. 1876.

of April, 1874. He gives statistical tables and details concerning the careers of the men selected by competition, and a general account of the examinations and of the organization in which the civil servant takes his place. The evidence against selection by competition seems to come to this, that, after a most complete inquiry, the worst that can be made out against the "Competition Wallahs" is that some of them do not ride well and that there is a doubt in some cases about the polish of their manners, or the sweetness of their culture.

Doubt, indeed, was thrown by some writers upon the physical suitability of selected candidates; but on this point a most remarkable fact was brought to light. All the candidates for the Indian Civil Service have to undergo two strict medical examinations before Sir William Gull, so that this eminent physician is able to speak with rare authority as to the physical health of the candidates. This is what he says (Report, p. 36): "I still continue to be impressed with the fact that a sound physical constitution is a necessary element of success in these competitive examinations. The men who have been rejected have not failed from mere weakness of constitution, but (with only a solitary exception or two) from a mechanical defect in the valves of the heart in otherwise strong men, and, for the most part, traceable to over-muscular exercises. . . . There is a somewhat prevalent opinion that the courses of study now required for the public service are calculated to weaken the physical strength of candidates. Experience does not only not confirm this, but abundantly proves that the course of life which conduces to sound intellectual training is equally favorable to the physical health of the student."

Unless, then, we are prepared to reject the opinion of the physician who has had the best possible means of forming a sound conclusion, a competitive examination is actually a good mode of selecting men of good physical health, so closely are the mental and bodily powers correlated as a general rule.

It is impossible that I should, in a single article, treat of more than two or three of the principal arguments which may be urged in defense of the examination-system. Did space admit, I might go on to point out the great improvement which has taken place in education since effective examinations were established. The condition of Oxford and Cambridge as regards study in the present day may not be satisfactory, but it is certainly far better than at the close of the last century. The middle-class schools are yet far from what they ought to be, but the examination-system, set on foot by the old universities, is doing immense good, giving vigorous and definite purpose where before a schoolmaster had hardly any other object than to get easily through the "half." Primary schools would for the most part be as bad as the old dames' schools, did not the visits of her majesty's inspectors stir them up to something better. In one and all of the grades of English education, to the best of my belief, examination is the sheet-anchor to which we must look.

I will not conclude without adverting briefly to a few of the objections urged against the examination-system. Some of these are quite illusory; others are real, though possibly exaggerated. No institution can be an unmixed good, and we must always strike a balance of advantage and disadvantage. One illusory objection, for instance, is urged by those who take the high moral ground and assert that knowledge should be pursued for its own sake, and not for the ulterior rewards connected with a high place in the examination-list. The remarks of these people bring before the mind's eye the pleasing picture of a youth burning the midnight oil, after a successful search for his favorite authors. We have all of us heard how some young man became a great author, or a great philosopher, because, in the impressible time of boyhood, he was allowed to ransack the shelves of his ancestral library. I do not like to be cynical, but I cannot help asserting that these youths, full of the sacred love of knowledge, do not practically exist. Some no doubt there are, but so small is the number with which the school or college teacher will meet in the course of his labors, that it is impossible to take them into account in the general system. Every teacher knows that the bulk of a junior class usually consists of intellects so blunt or so inactive that every kind of spur is useful to incite them to exertion.

Nor do I believe that the few who are by nature ardent students need suffer harm from a well-devised system of university examinations. It is very pleasant to think of a young man pursuing a free and open range of reading in his ancestral library, following his native bent, and so forth; but such study directed to no definite objects would generally be desultory and unproductive. He might obtain a good deal of elegant culture, but it is very doubtful whether he would acquire those powers of application and concentration of thought which are the basis of success in life. If

a man really loves study and has genius in him, he will find opportunities in after-life for indulging his peculiar tastes, and will not regret the three or four years when his reading was severely restricted to the lines of examination. Of course, it is not desirable to force all minds through exactly the same grooves, and the immense predominance formerly given to mathematics at Cambridge could not be defended. But the schemes of examination at all the principal universities now offer many different branches in which distinction may be gained.

The main difficulty which I see in the examination-system is that it makes the examiner the director of education in place of the teacher, whose liberty of instruction is certainly very much curtailed. The teacher must teach with a constant eye to the questions likely to be asked, if he is to give his pupils a fair chance of success, compared with others who are being specially "crammed" for the purpose. It is true that the teacher may himself be the examiner, but this destroys the value of the examination as a test or means of public selection. Much discussion might be spent, were space available, upon the question whether the teacher or the examiner is the proper person to define the lines of study. No doubt a teacher will generally teach best, and with most satisfaction to himself, when he can teach what he likes, and, in the case of university professors or other teachers of great eminence, any restriction upon their freedom may be undesirable. But as a general rule examiners will be more able men than teachers, and the lines of examination are laid down either by the joint judgment of a board of eminent examiners, or by authorities who only decide after much consultation. The question, therefore, assumes this shape: Whether a single teacher, guided only by his own discretion, or whether a board of competent judges, is most to be trusted in selecting profitable courses of study.

Few have had better opportunity than I have enjoyed, both as teacher and examiner in philosophical and economical subjects, of feeling the difficulties connected with a system of examination in these subjects. Some of these difficulties have been clearly expounded in the series of articles upon the state of philosophical study at the different universities published in *Mind*. It is hardly needful to refer to the excellent discussion of the philosophical examination in the London University by the editor in No. IV. I should not venture to defend university examinations against all the objections which may be brought against them. My purpose is accomplished in attempting to show that examination is the most effective way of enforcing a severe and definite training upon the intellect, and of selecting those for high position who show themselves best able to bear this severe test. It is the popular cry against "cram" that I have answered, and I will conclude by expressing my belief that any mode of education which enables a candidate to take a leading place in a severe and well-conducted open examination must be a good system of education. Name it what you like, but it is impossible to deny that it calls forth intellectual, moral, and even physical powers, which are proved by unquestionable experience to fit men for the business of life.

This is what I hold to be education. We cannot consider it the work of teachers to make philosophers and scholars and geniuses of various sorts; these, like poets, are born, not made. Nor, as I have shown, is it the business of the educator to impress indelibly upon the mind the useful knowledge which is to guide the pupil through life. This would be "cram" indeed. It is the purpose of education so to exercise the faculties of mind that the infinitely various experience of after-life may be observed and reasoned upon to the best effect. What is popularly condemned as "cram" is often the best-devised and best-conducted system of training toward this all-important end.—*Mind*.

THE RADIOMETER AND ITS LESSONS.

By WILLIAM B. CARPENTER, M. D., F. R. S.

SOMEWHAT less than two years ago, the large assemblage of scientific men gathered at the *soirée* of the Royal Society was startled at the sight of a phenomenon which was altogether new and strange to the great majority of them. In the interior of a thin glass globe, about the size of a small orange, prolonged below into a cylindrical stem by which it was supported on a stand, Mr. Crookes presented to our view an horizontal cross of four slender arms radiating at right angles from a common centre; the extremity of each arm carried a thin disk about the size of a threepenny-piece, black on one side and white on the other, the black sides all facing alike; while beneath the centre was a pointed steel pivot, resting on a cup that formed the summit of a rod fixed into the cylindrical stem,[1] on which the cross with its terminal disks was free to revolve horizontally—exactly after the fashion (in miniature) of Dr. Robinson's cup-anemometer for recording the velocity of wind. The globe, Mr. Crookes informed us, had been exhausted of air to the utmost degree attainable by the "Sprengel pump" as improved by himself, and had been then hermetically sealed. Without any other perceptible agency than the general light of the apartment, the cross slowly rotated horizontally in the direction of the white sides of the disks. When a candle was brought within a foot or so of the globe, the rotation became much quicker. When the candle was approximated to within two or three inches of the globe, the cross spun rapidly round. And when a piece of magnesium wire was burned close to it, the rapidity of the rotation became so great that the disks could no longer be separately distinguished!

The effect was not perceptibly diminished by the interposition, between the globe and the candle or other source of light, of a glass trough containing a solution of alum, which, while transparent to light, stops a large part of the radiant heat which accompanies it. And—what was yet more remarkable—if, while the cross was rotating rapidly under the influence of a candle within a short distance, the flame of a spirit-lamp was made to play over the surface of the globe, the rotation was checked in a very peculiar manner; the cross being, as it were, pulled up with a jerking action, much as when the swinging of a compass-needle is stopped by the attraction of a magnet brought near it. When, on the other hand, the spirit-lamp was withdrawn, the candle remaining where it was, the rotation commenced anew as the globe cooled.

It is scarcely surprising, then, that a general impression should have at once prevailed that a capital discovery had been made—that of the *direct mechanical action of light;* which, though not indicating the existence of a new force in Nature, showed that the most universally diffused of all forces, next to gravitation, has a *mode of action* which was previously not merely unknown, but altogether unsuspected. And this impression was not confined to those who had only a general acquaintance with physical optics; for it was shared by the greatest masters of that department of science, who had followed the course of the experimental researches on which Mr. Crookes had been for some time engaged, and of which this discovery was the culmination.

The origin of these researches was rather singular. In the course of the weighings made by Mr. Crookes to determine the atomic weight of the new metal *thallium*, his discovery of which by spectrum analysis had acquired for him deserved distinction as a chemist, he noticed that when the balance was inclosed in a case, and the substance weighed was of a temperature higher than that of the surrounding air and apparatus, there was an interference with the due action of the balance, which seemed attributable to the currents set up in the air within the case by the inequality of its temperature. Experiments were then made to render the action more sensible, so as to discover and eliminate sources of error; and in the course of these it was discovered that, when a small light body is delicately suspended in the most perfect vacuum that can be produced, it is *repelled* by radiant heat or light, although the same body suspended in the same vessel, from which the air has not been exhausted, seems *attracted* by the same radiant force. This can be demonstrated by suspending

[1] In the radiometer as now constructed, the arms radiate from an inverted cup, which rests upon the pointed pivot—an arrangement that is in many respects more convenient.

a bar of pith by a fibre of cocoon-silk within a glass globe, so as to constitute what is known as a "balance of torsion," and subjecting one end of this bar to the influence of heat. When the globe is full of air, the warmed end of the bar swings toward the source of heat; but, when the globe has been thoroughly exhausted and hermetically sealed, the bar is made to swing away to the extent of 90°, by merely touching with the finger the part of the globe near one of its extremities; while, on the other hand, it follows a piece of ice as a suspended needle follows a magnet. These contrary effects are very strikingly shown when two similar globes, each having a pith-bar suspended in it, but the one full of air and the other exhausted, are placed side by side, and a hot glass rod on the one hand, and a piece of ice on the other, are moved round each in succession. For the bar in the unexhausted globe behaves exactly with the heated rod as the bar in the exhausted globe does with the ice; and the bar in the unexhausted globe behaves with the ice exactly as the bar in the exhausted globe behaves with the heated rod. Again, when a candle is brought within about two inches of a well-exhausted globe, the pith-bar begins to oscillate backward and forward, its swing gradually increasing until its position is reversed; and when the "dead centre" has been passed it revolves continuously, until the torsion of the suspended fibre offers a sufficient resistance to prevent any further movement in the same direction. A contrary revolution then begins, which proceeds as far in the opposite direction, the alternating series of revolutions being kept up as long as the candle burns.

A still more sensitive apparatus of the like kind was afterward devised by Mr. Crookes, in which two disks of pith were attached to the extremities of a very slender glass rod, and this was suspended horizontally by a fine fibre of spun glass; the whole being hermetically sealed within a glass vessel of suitable form, from which the air was removed as completely as possible. The advantage of suspending the beam by a *glass* fibre lies in its elasticity; which is so perfect, that, however much the fibre may have been twisted, the beam always returns accurately to zero when free to do so. And by drawing out the fibre to the requisite degree of fineness, this "torsion-balance" may be made of any degree of sensitiveness that may be required; one which was used in Mr. Crookes's subsequent experiments being so delicate as to turn to *the millionth of a grain.*

From this form of apparatus, the transition was obvious to one in which the arms, instead of being suspended by a fibre, should rest on a point, so as to be free to rotate continuously in either direction; and thus originated the *radiometer*—the name given to it by Mr. Crookes being intended to express its action as a measurer of the *mechanical* power directly exerted by that radiant energy which had been previously known to manifest itself only under the forms of light, heat, and actinism (or chemical agency). This was the sense in which its phenomena were brought under discussion at the ordinary meeting of the Royal Society next following the first exhibition of the radiometer; and so demonstrative did these seem to be of "A Repulsion resulting from Radiation" (the title of Mr. Crookes's memoir), that no one of the eminent physicists present on the occasion called his interpretation of them in question; Prof. Stokes, in particular, confining himself to the statement that such mechanical action must lie *outside* the undulatory theory, which deals only with light *as* light—i. e., as producing visual phenomena. But it was noticed by several as anomalous, that the *black* should be the "driving" side of the disks, since it might have been anticipated that the mechanical action of light would manifest itself in pushing away the surface from which its rays are reflected, and that the surface into which they are absorbed would move toward the source from which the rays emanate.

In subsequent communications to the Royal Society, Mr. Crookes committed himself explicitly to the doctrine that the radiometer (to which he also gave the name of "light-mill") is driven by *light*, the mechanical effect of which he assumed to be proportional to its illuminating power; so that an exact measurement of the former would furnish an equally exact measurement of the latter. And thus, as a thermometer, which measures *heat* by its physical action in producing expansion, is a far more trustworthy instrument than the human hand, the action of heat upon which gives rise to a sensation that is not capable of precise measurement, and may be altogether deceptive, so he contended the radiometer, which measures *light* by its physical power of repulsion, is a far more exact photometer than any which depends upon the physiological action of light upon the retina.

For the *absolute* measurement of the repulsive force exerted by radiation, Mr. Crookes employed the delicate torsion-balance already described, and found the mechanical effect of the light of a candle at twelve inches' distance, acting on two

square inches of surface, to be 444 *millionths* of a grain. This he called "weighing a beam of light." In his subsequent lecture at the Royal Institution, he stated it as the result of his experiments that the radiant energy of the sun equals that of 1,000 candles at twelve inches' distance, its mechanical power upon two square inches of surface being thus equal to 444 *thousandths* of a grain. This is equivalent to about 32 grains per square foot, to two hundred-weight per acre, to 57 tons per square mile, or to nearly 3,000,000,000 tons on the exposed surface of the globe—sufficient to "knock the earth out of its orbit if it came upon it suddenly," and to "drive the globe into space if it were not counteracted by the force of gravitation." But, as Mr. Crookes considerately added, "it must be remembered that our earth is not a lamp-blacked body inclosed in a glass case; nor is its shape such as to give a maximum of surface with the minimum of weight."

For *comparative* estimates, however, Mr. Crookes devised another form of "torsion-balance," in which one half of the pith-bar was blacked and the other left white, so that, when the whole was subjected to a broad beam of light, the bar would be made to swing by its different action on the white and on the black surfaces. This bar being made to carry a mirror and a small magnet, its slightest deflection from the north and south zero could be detected by the movement of a spot of light reflected from the mirror along a graduated scale: while the mechanical force required to produce any degree of deflection could be very exactly estimated, the apparatus being made more or less sensitive as desired by the use of a controlling magnet on the outside. The results of a long series of experiments served to show the photometric value of this apparatus when lights of the *same* kind were compared; the amount of deflection produced by the light of the same standard candle at different distances being obviously conformable to the law of inverse squares, while the effect of two such candles placed side by side was found to be practically double that of a single candle, and that of three candles practically triple. Again, when a candle was placed on either side of the apparatus and equidistant from it, so that each would neutralize the effect of the other, the index-spot of light remained at zero; but, by shading one or other of the candles, the index-spot was made to fly off to the extremity of the scale.

This arrangement afforded a ready means of comparing the radiant energy of *different* sources of light. Thus, if a "standard candle" was placed on one side at a distance of 48 inches, and a gas-burner on the other was found to bring the index-spot to zero when removed to a distance of 113 inches, their relative motor powers would be as 48^2 to 113^2—that is, the radiant energy of the gas-burner was equal to that of $5\frac{1}{2}$ candles. But it was as pure an assumption on Mr. Crookes's part to affirm that the *mechanical* action exerted by two flames of different kinds would measure their relative *illuminating* powers as it would have been to say that their heating action would be proportional to their illuminating action, which we know perfectly well *not* to be the case—the gas-flame, as every one knows, having a much greater heating-power than the candle-flame in proportion to the light it gives.

The same form of "torsion-balance" was employed by Mr. Crookes to determine the relative effects of the interposition of screens of different kinds. Thus, a deflection to 180° being produced by a candle at three feet distance, its amount was reduced to 161° by the interposition of a screen of yellow glass, to 128° by a screen of red glass, and to 102° and 101° respectively by screens of blue and green glass. A far more potent effect, however, was produced by the interposition of a glass trough containing water, which brought down the deflection to 47°, while a screen formed of a plate of alum reduced it to 27°. As the absorption of the luminous rays in passing through such transparent media must have been very slight, while they practically cut off the rays of "dark heat," this marked reduction would seem mainly attributable to the abstraction of the latter; but, strong in his conviction of the immediate mechanical effect produced by radiation, Mr. Crookes thus expressed himself in regard to it: "There is no real difference between heat and light; all we can take account of is difference of wave-length, and a ray of a definite refrangibility cannot be split up into two rays, one being heat and one light. Take, for instance, a ray of definite refrangibility in the red. Falling on a thermometer it shows the action of heat; on a thermopile it produces an electric current; to the eye it appears as light and color; on a photographic plate it causes chemical action; and on the suspended pith it causes motion." Now, so far as light, heat, and chemical action, are concerned, this mode of expressing their relations is undoubtedly that which all physicists now accept; these agencies being regarded, not as separate and distinct, but as different manifestations of that one physical action which constitutes radiation. This action, according to the

undulatory theory, consists in the propagation, through an ethereal medium, of systems of waves of different lengths; and it is in virtue of this difference that their direction is more or less altered by refraction, the longest waves being *least* and the shortest *most* deflected by passing through the prism. The solar beam is the composite resultant of the whole aggregate of these undulations. When falling on the eye, it excites the sensation of colorless light; when falling on the hand, it affects us with the sensation of warmth; when falling on the bulb of the thermometer it causes the expansion of the mercury; and, when falling on a photographic surface, it produces chemical change. But, when made to pass through a prism, it is decomposed not only into that succession of color-bands, formed by rays of different degrees of refrangibility, which constitutes the luminous spectrum, but into two other successions of rays, one of much *lower* and the other of much *higher* refrangibility, which lie beyond the two ends of the luminous spectrum.

These dark rays are not recognizable by the eye, because the retina is no more sensible to them than the ordinary cutaneous surface is to luminous impressions; but their heating power can be measured by a thermometer or a thermopile, and their chemical power by the action they excite on a photographically-prepared surface. The heating power is thus found to attain its maximum a little outside the red end of the color-spectrum; and from that point it progressively diminishes toward the violet end of the luminous spectrum, beyond which it is scarcely traceable; while it diminishes in the contrary direction also, until it dies out at about the same distance from the maximum on one side as that at which the violet lies on the other. The illuminating power has its maximum in the yellow band of the spectrum, and shows a gradual reduction toward the violet end, a more rapid toward the red. The chemical power, on the other hand, has its maximum in the violet band; and, while it gradually diminishes toward the red end of the luminous spectrum, beyond which it is scarcely traceable, it diminishes at about the same rate in the opposite direction, dying out at nearly the same distance from the maximum on one side as that at which the red lies on the other. Thus, while the rays of *low* refrangibility, whose wave-length exceeds 812 millionths of a millimetre, are characterized almost exclusively by their *heating* power, and those of *high* refrangibility, whose wave-length is less than 400 millionths of a millimetre, are characterized almost exclusively by their *chemical* power, the rays of *medium* refrangibility, whose wave-lengths are between 400 and 800 millionths of a millimetre, combine these with *illuminating* power, in proportions varying with their respective wave-lengths. But there is no more reason, as Mr. Crookes has justly remarked, for attributing these several effects to different rays, than there is for hypothetically splitting up the element iron (for example) into a number of components, of which one gives its specific gravity, a second its chemical reactions, a third its magnetic properties, and so on.

But, to the *three* attributes of radiation universally recognized by physicists, Mr. Crookes proposes, in the passage already cited, to add a *fourth*—the power of producing an electric current in a thermopile; and a *fifth*—the power of producing a mechanical motion when acting on light bodies freely suspended in a vacuum. Now, the notion that radiation *directly* excites the electric current of a thermopile is one, I apprehend, which no well-informed physicist would indorse; for, as the name of the instrument implies, it is by the disturbance of the *thermal* equilibrium between the two metals of which it is composed that the electric current is produced. And, since this disturbance may be produced in a variety of ways (as by friction or conduction), and the potency of the electric current is strictly proportional to the amount of that disturbance, there is no reason whatever for attributing to radiation any other power of exciting an electric current than that which it exerts *mediately* through its power of heating the thermopile. And the question which, after the first shock of novelty passed off, has greatly exercised the minds of physicists, is whether the mechanical motion, also, is not an *intermediate* effect of some one of the previously-known forms of radiant energy—that which first suggests itself being the action of heat upon that residual vapor of which it is impossible to get rid entirely by any means at present known.

This idea very early occurred to some of the distinguished physicists who took most interest in the experiments first communicated by Mr. Crookes to the Royal Society. I more than once conversed with Wheatstone on the subject; and he expressed a very strong belief that the swinging round of the pith-bar was due to the disturbance of the thermal equilibrium in the residual vapor, dwelling very strongly upon the impossibility of obtaining a *perfect* vacuum, since "even glass," he said, very emphatically, "would give off a vapor if all other vapor were withdrawn." On the other hand, two of the most distinguished

among British mathematical physicists, whose opinions I had the opportunity of learning from themselves, were disposed to concur with Mr. Crookes in regarding the repulsion of the heated end of the pith-bar as an *immediate* effect of radiant energy; dwelling especially on the fact that the repulsion was stronger in proportion to the completeness of the vacuum, from which it seemed fair to infer that it would be *most* strongly manifested in a *perfect* vacuum (if such could by possibility be obtained), in consequence of the entire removal of mechanical resistance (save the friction of the pivot) to the rotation of the mill.

Now, since our belief in Newton's "First Law of Motion" has no other experiential basis than the fact that, the more completely we can eliminate friction and the resistance of the air, the longer is the persistence of motion in a body once put in movement, provided that no opposing force be brought to bear upon it, this argument for the directness of radiant repulsion seemed alike valid and cogent. We shall presently see, however, that it proves fallacious when brought to an experimental test of greater delicacy.

The doctrine propounded by Mr. Crookes was first explicitly called in question in a communication made to the Royal Society on the 18th of June, 1874, by Prof. Osborne Reynolds; who maintained that, on the *kinetic* theory of gases (which represents any gaseous substance as consisting of molecules constantly in motion at great velocities), the effect on the torsion-balance is really due to alternate evaporation of vapor from, and its condensation at, the surface of the pith; evaporation producing a reactionary force equivalent to an increase of pressure on the heated surface, while condensation must be attended with a force equivalent to a diminution of pressure over the cooling surface. Thus, when the heat radiated from the lamp falls on the pith, its temperature will rise, and any moisture on it will begin to evaporate, thus generating a mechanical force which will drive the pith *from* the lamp. Conversely, when a piece of ice is brought near, the temperature of the pith will be reduced, causing a condensation of vapor which will cause the pith to move *toward* the ice. When the two arms of the pith-bar are unequally exposed to heat, the evaporation will be greatest in that which is nearest the lamp; and this is driven away, therefore, until the force on the other arm becomes equal, after which the bar will come to rest, unless the momentum it has acquired in swinging carries it farther.

In a subsequent communication (March 23, 1876) Prof. O. Reynolds applied a similar doctrine to the continuous rotation of the "light-mill;" maintaining, from theoretical considerations, the existence of reactionary forces, or "heat-reactions," whenever heat is communicated from a surface to a gas, and *vice versa;* and showing that there is enough residual air in the best exhausted globe to enable an amount of force to be thus developed, which is sufficient to keep up the rotation of its contained mill. This explanation obviously implies the existence of a reactionary force, communicated by the intervening gas, between the disks of the mill and the inclosing glass; and the existence of such a reaction was experimentally proved by an ingenious arrangement first devised by Dr. Schuster, and subsequently improved on by Mr. Crookes. A radiometer, on whose arms a magnet is fixed, is floated in a vessel of water, round which four candles are fixed, so as to keep the mill in rotation. When a powerful magnet is brought near the outside of the globe, the arms immediately stop; but at the same time the globe begins to revolve slowly in the opposite direction, and continues to do so as long as the candles burn, and the arms remain fixed by the magnet. When the magnet is removed, the "mill" begins to rotate in its original direction, and the glass envelope quickly comes to rest.

Now, as the existence of a *reactionary* force, which seems unmistakably indicated by this experiment, cannot be accounted for on the supposition that the "mill" is driven round by the immediate mechanical impulse of radiation, while it is exactly what would be anticipated if the radiant energy acts calorifically on the residual gas, a very strong support is obviously afforded to the latter interpretation. And hence, although physicists may differ as to the precise manner in which the unequal heating of the disks produces the movement,[1] there is now, I believe, a very general accordance in the conclusion that this is the real *modus operandi* of the radiant energy; so that, instead of either a "new force," or a "new mode of force," we have simply a well-known mode of force acting under peculiar conditions.

This conclusion derives very striking confirmation from two of Mr. Crookes's more recent experiments, which seem to possess a *crucial* value. Having still further improved his "Sprengel pump," he has been able to carry the exhaustion of his globe to a yet greater degree than before, so that its internal condition more nearly

[1] *See* Mr. Johnstone Stoney, in *Philosophical Magazine*, April, 1876.

approaches a perfect vacuum. Now, while the rate of rotation of the "mill" at first increases with the degree of attenuation of the gaseous atmosphere in which it moves, and ought, on Mr. Crookes's original principle, to go on increasing, it is found to attain its maximum at a certain degree of exhaustion, and, when the exhaustion is carried beyond that degree, to undergo a retardation; and this can scarcely be accounted for in any other way than on the supposition that the mechanical power exerted by the disturbance of thermal equilibrium in the residual gas then diminishes at a more rapid rate than its mechanical resistance to the rotation of the disks. Again, it has been found that when the place of air in several radiometers is taken by different gases (as oxygen, hydrogen, carbonic acid, etc.), and their globes are all exhausted to the same degree, as tested by a delicate pressure-gauge, their "mills" rotate at different rates. Now, this is exactly what would be expected on the *kinetic* theory of gases; since these different gases have such diverse rates of molecular movement that the reactionary forces generated by the disturbance of thermal equilibrium will likewise vary; while, on the other hand, there seems no reason whatever why the rate of rotation should be affected by the nature of the residual gas (its elastic force, and therefore the mechanical resistance it exerts remaining the same), if the repulsion of the disks is *directly* produced by radiant energy.

Before adverting to the lessons which this remarkable history seems to me to convey, I would point out that this change of interpretation of the facts discovered by Mr. Crookes does not in the least diminish either the interest of the facts themselves, or the merit of his discovery. Nor is the value of his radiometer in any degree lowered by the demonstration that it does not (as Mr. Crookes at first supposed) afford a mechanical measure of radiant energy under any of its aspects. What (according to present views) it really does measure is the amount of "heat-reaction" producible in gaseous atmospheres of different kinds and of different degrees of attenuation. And such a precise method of measurement appears more likely than any other mode of investigation to furnish a test of that *kinetic* theory of gases, the recent development of which by Prof. Clerk-Maxwell is regarded by competent judges as constituting (if it should receive such verification) the most important advance ever made in molecular physics. Most deservedly, therefore, did Mr. Crookes receive from the Royal Society the award of one of its chief distinctions; and I would not be thought for one moment to disparage his merits as the inventor of the radiometer by now bringing into contrast with the admirable series of scientific investigations which led up to that invention what I cannot but regard as his thoroughly unscientific course in relation to another doctrine of which he has put himself prominently forward as the champion.

In the *Quarterly Journal of Science* for July, 1871, there appeared a paper by Mr. Crookes, entitled "An Experimental Investigation of a New Force," in which he not only gave an account of his own experiences with Mr. Home and other spiritualistic "mediums," but indulged in very unseemly reflections on the conduct of "scientific men," whom he charges with having "refused to institute a scientific investigation into the existence and nature of facts asserted by many competent and credible witnesses, which they are freely invited to examine when and where they please." The principal evidence adduced by Mr. Crookes for the existence of this "new force" was the power he attributed to Mr. Home of being able to "alter the weight of bodies," the chief proof of which was Mr. Home's depression of a lever-board, whose farther end was attached to a spring-balance, by laying upon it near its fulcrum the tips of the fingers of both his hands; placing a small hand-bell under one hand, and a little card match-box under the other, to satisfy the by-standers that he was not himself exerting any downward pressure. Now, "common-sense" would teach that, if the end of a board kept up by a spring goes down when a man's hands are laid upon it, however near to its fulcrum, its going down is due to the pressure of those hands; and the *onus probandi* obviously lies with those who affirm that it is *not* so. Nothing would have been easier than for Mr. Crookes, on the one hand, to have carefully watched Mr. Home, to have precisely imitated his whole procedure, and to have done his best to depress the board to the same degree by his own muscular effort; and, on the other hand, to have devised an "indicator" for *downward* pressure (on the principle of Faraday's for *lateral* pressure), by which it could be at once determined whether Mr. Home could depress the lever-board without such muscular effort. But, although Mr. Crookes, so far as I am aware, has never published any proof obtained from either of these test-experiments, although explicitly challenged to do so,[1] he leaves on record the claim to the possession of a power to

[1] *Quarterly Review*. October, 1871, p. 345.

alter the weight of bodies which he originally advanced for Mr. Home, together with his own assertion of the existence of a "new force," and his charge against "scientific men" for not experimentally investigating it. Their justification for abstaining from such an investigation was the utter unreliability of the evidence adduced, which consisted simply in Mr. Home's assertion that he *was not* exerting downward pressure, and in Mr. Crookes's belief that he *could not* thus have produced the effect; but, having previously allowed himself to become "possessed" by the spiritualistic idea, Mr. Crookes could not see this fallacy, accepted Mr. Home's assertion as a scientific fact, and scolded "scientific men" for their incredulity! And yet, while asserting that they were "freely invited to examine" (these asserted facts) "when and where they please," Mr. Crookes admitted that Mr. Home's preternatural power could not be commanded, that he was "subject to unaccountable ebbs and flows of this force," and that "it has but seldom happened that a result obtained on one occasion could be subsequently confirmed and tested with apparatus specially contrived for the purpose."

Now, this is precisely what has happened over and over again within my own and others' experience of these pseudo-scientific phenomena which depend upon the instrumentality of a human *personnel*. Thus it was claimed by Mr. Lewis, a noted mesmerist of twenty-five years ago, that he could not only draw his somnambules after him by mesmeric traction, but could raise them off the ground against the force of gravity.

"When Mr. L. stood on a chair," says Dr. Gregory,[1] "and tried to draw Mr. H. without contact from the ground, he gradually rose on tiptoe, making the most violent efforts to rise till he was fixed by cataleptic rigidity. Mr. Lewis said that, had he been still more elevated above Mr. H., he could have raised him from the floor without contact, and held him thus suspended for a short time, while some spectator should pass his hand under the feet. Although this was not done in my presence," continues Prof. Gregory, "yet *the attraction upward was so strong* that I see no reason to doubt the statement made to me by Mr. Lewis and by others who saw it, that this experiment has been successfully performed."

Yet when a committee of Aberdeen professors subsequently tested Mr. Lewis's powers, under conditions admitted by himself to be perfectly fair,[2] not only did he entirely fail in his endeavor to control the actions of his "subjects" from a distance, but, finding himself unable to keep either of them, when standing sideways against a wall on the foot nearest to it, in the erect position, he explained that he had never claimed any other power of overcoming the force of gravity than that which he exerted in causing a subject lying on the ground, by the traction of his hand above him, to rise and stand upright. This is the Mr. Lewis whose pretensions have been recently indorsed by Mr. Alfred R. Wallace; a gentleman for whose achievements in the domain of natural science I have the same respect as I have for those of Mr. Crookes in the line of physical research, but all whose statements on this subject are vitiated (like those of Mr. Crookes) by his deficient knowledge of the abnormalities of *human* nature, by his want of due discrimination between *facts* and *inferences*, and by his disability to perceive how much greater should be the cogency of the evidence adduced to command our belief in statements of a most *extraordinary* kind, than that on which we rest our acceptance of the *ordinary* facts of daily life.

Thus, to revert to the cases just cited, the *fact* in the first of them was simply that the lever-board went down when Mr. Home's hands were laid upon it; and the testimoney of Mr. Crookes and his friends was quite sufficient to justify others in accepting it as such. On the other hand, Mr. Crookes's assertion that the lever-board went down in obedience to some other force than that of Mr. Home's muscular pressure was *not* a fact, but an inference drawn by Mr. Crookes; and this inference he had no scientific right to draw, until he had assured himself by every conceivable test that Mr. Home *did* not and *could* not so depress it. So, again, the rising-up of Mr. Lewis's subject from the prostrate to the erect position, under Mr. Lewis's outstretched hand, was a *fact* as to which Prof. Gregory's testimony may be unquestioningly accepted, since it involves no improbability whatever; but of Mr. Lewis's power to lift him *off* the ground, and to keep him suspended in the air, we obviously require a much stronger assurance than the assertion made to Prof. Gregory by Mr. Lewis, and by others who saw it. And those who refused to accept that assertion at the time were fully justified by Mr. Lewis's explicit disavowal of it to the Aberdeen professors a few months afterward.

So, again, Mr. Wallace's recently reiterated affirmation of the possession of the *clairvoyant* power by Alexis, Adolphe, and other somnambules, is merely the believer's *inference* from facts which no extraordinary testimony is needed to establish,

[1] "Letters on Animal Magnetism," p. 351.

[2] *Edinburgh Monthly Journal of Medicine*, 1852.

viz., that they read books or played cards with their eyes bandaged, or deciphered words in closed boxes put into their hands. But the skeptic's "common-sense" inference from the very same facts would be that, in the first case, the eyes of the supposed *clairvoyants* had not been effectually blinded; and, in the second, that they had either taken a sly peep into the boxes (as George Goble was detected in doing), or had guessed the word by "fishing" with the help unconsciously given by the questioner, as I saw Alexis and Adolphe do many times. And that this latter inference is the true one, is indicated, on the one hand, by the failure of one performer after another under adequate test-conditions (as in the cases investigated by the French Academy of Medicine and Sir John Forbes, and in many besides), and, on the other, by the detection of the mode in which the cheat was practised. I am confident that Mr. Wallace cannot point to a single case of *clairvoyance* thoroughly investigated by a skeptical expert, which has survived such investigation. But of cases which satisfied intelligent and truthful witnesses, upon whose testimony we should rely in the ordinary affairs of life, and who were yet afterward proved to have been completely taken in, there are enough to show how little such testimony is worth as to matters requiring special qualifications for their thorough investigation.

Of the two distinct claims set up by Mr. Crookes, therefore, to the discovery of a new agency in Nature, I hold the one to have been as scientific as the other was unscientific. The *facts* of radiant repulsion did not rest upon the unsupported testimony of Mr. Crookes and his friends; they could be exhibited to as many as wished to see them, and could be verified for himself by every one who could construct the apparatus. And while his *inference* from the first series of those facts (ascertained by the torsion-balance) was regarded by some of our most eminent physicists as by no means improbable, there were few, if any, among those who saw the radiometer spin round when a candle was brought near it, who did not for a time accept his view. In assuming, however, that there was such a quantitative relation between radiant repulsion and light as justified the use of his radiometer as a photometer, Mr. Crookes undoubtedly went beyond what his facts warranted; and his claim to have "weighed a beam of light" I feel sure that he would now abandon. But no sooner was adequate ground shown for calling in question his interpretation of the phenomena, and a *vera causa* found in an agency already known, than Mr. Crookes evinced the spirit of the true philosopher in varying his experiments in every conceivable mode, so as to test the validity of his original interpretation. And if he still shows some lingering unwillingness to surrender his position, it is no more than the best of us would probably feel under the like circumstances in regard to a pet hypothesis.

Yet at the very time that Mr. Crookes was carrying out this beautiful inquiry in a manner and spirit worthy of all admiration, he gave to the public, in his "Notes of an Inquiry into the Phenomena called spiritual,"[1] the most conclusive evidence that his mind has its unscientific as well as its scientific side; so that, while pursuing with rare ability and acuteness a delicate physical investigation in which nothing is taken for granted without proof satisfactory to others as well as to himself, he has yet allowed himself to become so completely possessed by a "dominant idea" in regard to the "phenomena called spiritual," as to accept either the products of his own imagination, or the deceptions practised upon him by others, as facts that should command the same credence as the demonstrations of his radiometer. Of "The Alteration of Weight of Bodies," a class of phenomena capable of precise physical determination, Mr. Crookes simply says, "I have repeated the experiments already described in this journal, in different forms, and with several mediums." But why does he not tell us precisely what were the weights so altered, and what force was exerted by the medium, as determined in each case by the precise measurement he so well knows how to apply? Of his yet more extraordinary assertions, the following are samples:

"On one occasion I witnessed a chair, with a lady sitting on it, rise several inches from the ground. On another occasion, to avoid the suspicion of this being in some way performed by herself, the lady knelt on a chair in such a manner that its four feet were visible to us. It then rose about three inches, remained suspended for about ten seconds, and then slowly descend. At another time two children, on separate occasions, rose from the floor with their chairs, in full daylight, under (to me) most satisfactory conditions; for I was keeling and keeping close watch upon the feet of the chair, and observing that no one might touch them.—On three separate occasions I have seen Mr. Home raised completely off the floor of the room, once sitting in an easy-chair, once kneeling on his chair, and once standing up. There are at least a hundred recorded instances of Mr. Home's rising from the ground, in the presence of as many separate persons.

[1] *Quarterly Journal of Science*, January, 1874.

"A beautifully-formed small hand rose up from an opening in a dining-table, and gave me a flower; it appeared and then disappeared three times at intervals, affording me ample opportunity of satisfying myself that it was as real in appearance as my own. This occurred in the light in my own room, while I was holding the medium's hands and feet. I have more than once seen, first an object move; then a luminous cloud appear to form about it; and, lastly, the cloud condense into shape and become a perfectly-formed hand. In the light I have seen a luminous cloud hover over a heliotrope on a side-table, break a sprig off, and carry the sprig to a lady; and on some occasions I have seen a similar luminous cloud visibly condense to the form of a hand, and carry small objects about.—A luminous hand came down from the upper part of the room, and, after hovering near me for a few seconds, took the pencil from my hand, rapidly wrote on a sheet of paper, threw the pencil down, and then rose up over our heads, gradually fading into darkness."

Whether, since the exposure of Katie King in Boston (United States), the exhibition in the same city of the methods by which numerous "spiritualistic" tricks have been played, the publication in this country of the affidavit of Mrs. N. Culver, the near relative of the sisters Fox, as to the mode in which these originators of "spiritualism" played on the credulity of the public, and the imitation of many of the performances of its professors by Messrs. Maskelyne and Cooke, Mr. Crookes has begun to question whether he may not have been rather hasty in committing himself, I have no means of knowing; but I do not think that any save those who have themselves yielded to the same "possession" will entertain any doubt about the matter. Any one who reads the account of the New England witch-epidemic nearly two hundred years ago, will find that able, intelligent, and honest judges and juries, under the influence of a theological prepossession, allowed themselves to be "sadly deluded and deceived" (as they themselves afterward found out), to the extent of hanging some scores of innocent people; so that the curious "duality" of Mr. Crookes's mental constitution has plenty of parallels in past time, to say nothing of the present.

The lesson which this curious contrast seems to me most strongly to enforce is, that of the importance of training and disciplining the *whole* mind during the period of its development, of cultivating scientific habits of thought (by which I mean nothing more than strict reasoning based on exact observation) in regard to *every* subject, and of not allowing ourselves to become "possessed" by any ideas or class of ideas that the common-sense of educated mankind pronounces to be irrational. I would not for a moment uphold that test as an infallible one, But it ought to be sufficiently regarded to make us question the conclusions which depend solely upon our own or others' subjectivity; and to withhold us from affirming the existence of new agencies in Nature, until she has been questioned in every conceivable way, and every other possibility has been exhausted.—*Nineteenth Century.*

ON STIMULANTS.

By J. BURNEY YEO, M. D.

MY object in this paper is not to confine myself to the consideration of the effects of alcoholic drinks alone, but to regard the question of the uses and properties of the various beverages commonly consumed in this country from a general point of view, and to inquire what has been learned, from trustworthy physiological experiment and from medical and general observation, as to their influence on the human organism for good or for evil. A beverage of some sort is a physiological necessity. No one can exist without consuming a certain quantity of water, which is the essential basis of all drinks. It has been calculated that the body of a man weighing eleven stones contains sixty-six pounds of solid matters and eighty-eight pounds of water, and that he loses in various ways about six pounds of water in twenty-four hours, and this loss of water must be supplied in his food and drink. In the ordinary physiological processes nothing passes into the blood, and nothing passes out of it, without the intervention, in some way or other, of

water as a solvent.[1] It will thus be seen that water plays a most important part in relation to animal life and nutrition. It is also the agent by which the body is cleansed inwardly as well as outwardly, and it is as necessary, though not quite so obvious, that the interior of our bodies should be washed and made clean as the exterior.

In the processes of nutrition—in the physical and chemical changes—upon which life depends, effete waste products are constantly being discharged into the blood from the tissues of the body, and these have to be got rid of; for, if they are permitted to accumulate in the blood, the body becomes poisoned by them, and life is destroyed as certainly as if a large dose of prussic acid or opium were introduced from without. Men do, indeed, frequently die, poisoned by toxic agents which they manufacture within their own organisms.

One of the uses of water, taken into the body as a beverage, is to dissolve these effete products of the work of the organism, and so to convey them out of the body through the action of the secreting organs. Water is readily absorbed into the blood, and is rapidly discharged from it. In its rapid course through the body it washes, so to speak, the circulating fluid, and carries away, through the channels of excretion, substances, the retention of which in the blood would prove in the highest degree harmful. It may readily be imagined that pure, unadulterated water performs this function better than any modification of it which we may drink as a beverage. It is, however, quite true that some slightly-mineralized waters pass through the organism with even greater rapidity than pure water, on account of the stimulating action they most of them exercise on certain of the excretory organs. Mild alkaline waters may also, under certain circumstances, prove more cleansing than pure water, on account of their greater solvent action on some substances.

The quantity of water we need in the form of beverage depends greatly on the nature of the other substances we consume as food. With a dietary composed largely of succulent vegetables and fruit, very little of any kind of beverage is required. Much also depends on the manner in which our solid food is cooked—whether, in the case of animal food, the natural juices of the flesh are retained in it or not; much, too, will depend on those atmospheric and other conditions which determine the amount of fluid lost by evaporation from the surface of the body. The sensation of thirst is the natural warning that the blood wants water. I may here remark, incidentally, that it is not a wise custom to take excessive quantities of any fluid, even simple water, with our food, for by so doing we dilute too much the digestive juices, and so retard their solvent action on the solid food we have consumed. A draught of fluid, however, toward the end of digestion is often useful in promoting the solution and absorption of the residuum of this process, or in aiding its propulsion along the digestive tube. Hence the custom of taking tea a few hours after dinner, or seltzer or soda water a little before bedtime.

It was a necessary preliminary to my present inquiry that I should call attention to this fundamental physiological requirement. Moreover, I am willing to admit at the outset that water is the only beverage physiologically essential to healthy life. But is this admission of any real consequence? I think not; for our mode of life is rarely constructed in strict accordance with rigorous physiological or chemical analysis.

It is scarcely necessary that I should insist upon the fact that in practical life the strictly essential does not go for much. We need not only that which makes us live, but that also which makes us care to live. And, in my estimation, a delicate appreciation of the qualities of foods and beverages may fairly take its place among our cultivated and reasonable pleasures. I know some persons of intellectual habits who look upon eating and drinking as simply a necessary nuisance; and it has been said of the celebrated John, Lord Hervey, that he "breakfasted on an emetic, dined on a biscuit, and regaled himself once a week with an apple." But his meagre dietary did not make him an amiable or a virtuous person.

It has often been objected to the general use of stimulating beverages that they are luxuries, but I shall not discuss the question whether certain beverages are luxuries or necessaries. No reasonable person that I am acquainted with regulates his own life on any such narrow principle, and we have no right to apply such an unpractical test to the lives of others. The terms wholesome and unwholesome are more suited to my purpose. It concerns every one to know whether any acquired habit of life is immediately or remotely injurious to his physical organism.

In examining the influence for good or evil which the various beverages commonly consumed in this country exert on human life, it is neces-

[1] It is possible that some gaseous bodies may be an exception to this rule.

sary to consider them in two distinct classes: 1. Those which contain alcohol, i. e., the various wines, spirits, and beers; and, 2. Those which are non-alcoholic, as tea, coffee, and chocolate. Before I examine the effects of the more common beverages of the first class, it is necessary that I should review briefly certain points in connection with what has been called the "Alcohol Controversy." That controversy has turned chiefly on the question whether alcohol is or is not to be regarded as a food. Everybody admits that it is a poisonous agent when administered in large doses, and everybody also admits, except certain irreconcilable enthusiasts, that it is useful as a medicine, under certain conditions, in both large and small doses. On looking over the records of this dispute, one cannot help being struck with the fact that those who desired to decide the question against alcohol were never, in any of their experiments, content with giving it in moderate quantities, but invariably used large, intoxicating doses, and in the majority of instances doses which were actually poisonous; and from its effects in such quantities all their conclusions are deduced. This is certainly not satisfactory, for such a mode of procedure could only have the effect of proving what, I take it, every one is ready and anxious to admit—that the use of alcohol in poisonous or intoxicating doses cannot on any grounds be justified. But it leaves, as I shall hope to show, the moderate and occasional use of alcoholic beverages unaffected.

Years ago Liebig classed alcohol among heat-forming foods. Like starch and sugar, it contains carbon and hydrogen, which can undergo a process of combustion within the organism by the aid of oxygen admitted from without, and thus contribute to maintain the heat of the body—a most important function of food. Of course, in order to prove that alcohol does act thus as a food, it is necessary to show that it undergoes decomposition within the animal body. Some fifteen or twenty years ago, three French chemists (Lallemand, Perrin, and Duroy) originated a series of experiments, from which they concluded that this view of Liebig, that alcohol acts as food, was altogether erroneous. They appealed to their experiments as proving that all the alcohol taken into the system left it unchanged, passing out of the body in the secretions. To use a French expression, alcohol simply "made a promenade around the organism." It was not decomposed. It was not burned within the body. It was not a food. This view was gratefully accepted and made the most of by the total abstainers in this, country. It was put forward so authoritatively, and with such an appearance of conclusiveness, that those who had long held a contrary opinion were for the moment staggered. Yet these French chemists were wrong. They had given to dogs enormous doses of alcohol—nine ounces, in one instance, that is, an equivalent to three quarts of sherry. Three quarts of sherry to one dog! Was it to be wondered at that much unchanged alcohol appeared in the secretions? We are indebted to the late Dr. Anstie for an exposure of the fallacies of these experimenters. He, in conjunction with Dr. Dupré, proved that alcohol, when given in small and moderate doses, was almost wholly consumed within the organism, and that only a trifling portion passed out of the body in the secretions; and Anstie's conclusions were confirmed by the experiments of Schulinus.

So that Liebig's theory that there was a rapid and complete combustion of alcohol within the system turns out to be very near the truth. We may conclude, then, that when alcohol is taken in non-poisonous doses, a small portion is rapidly eliminated by the secreting organs, and the remainder is burned within the body as hydro-carbonaceous food. The oxygen necessary for this combustion, if not thus utilized, would have been expended in the oxidation of the proteine or albumenized tissues of the body, so that in proportion to the amount of alcohol oxidized or burned there is a corresponding diminution in the combustion of the nitrogenized tissues. Hence the usefulness of alcohol in some acute febrile diseases, and hence the French expression, applied to alcohol as well as to tea and coffee, that they are *boissons d'épargne*. It was because of this property of sparing the tissues that Liebig spoke of the use of alcoholic beverages as economical. If a laboring-man drank a pint or two of beer, he needed much less bread and meat. It also accounts for Dr. Hammond's personal experience related in his "Physiological Researches" (p. 55). He states that, having placed himself on a very insufficient allowance of food, he took daily with each meal half an ounce of alcohol, and under this regimen he found he gained rather than lost weight, and preserved, at the same time, the highest mental and bodily vigor. A case mentioned by Dr. Anstie is to the same effect: "A male, eighty-three years of age, intemperate for many years, took one bottle of gin per diem for twenty years; ate only one small fragment of toasted bread in the day." Being acquainted with many other facts of like

import, it was with a feeling of great disappointment that I discovered in what purports to be a popular scientific account of alcohol, eighteen thousand copies of which are said to be in the hands of the public, the following statement: "Alcohol cannot, by any ingenuity of excuse for it, be classified among the foods of man. It neither supplies matter for construction nor heat. On the contrary, it injures construction and it reduces temperature."[1] I wish, in the first place, to put alongside of this statement another contemporary utterance on the same subject. "It" (i. e., alcohol) "undergoes combustion in the body, maintains or increases the body-weight, and prolongs life on an insufficient diet. It is therefore entitled to be reckoned as a food."[2] Now, both these statements, of which I believe the latter to be unquestionably true, are founded on experiments, but Dr. Richardson's experiments appear to have been undertaken with that fatal desire to establish a preaccepted theory which is the bane of experimental science. In all his experiments he appears to have administered alcohol in poisonous or intoxicating doses, and then, when the system was struggling with the influence of a potent poison, he found some reduction of bodily temperature. "In man," he says, "it is confined to three-fourths of a degree;" that is, in what he calls the second stage of alcoholism. In plain English, when a man has taken enough alcohol to make him drunk, and when he is drunk, you may find the temperature of his body reduced three-fourths of a degree. But Dr. Richardson is compelled to admit that in the first stage of alcoholism "the external temperature of the body is raised." Now, no decent person, who may wish to know whether alcohol acts as a food or not, contemplates ever passing into that second stage, until he reaches which he may feel assured, even on Dr. Richardson's authority, that his body temperature will be raised and not lowered.

A great deal has been said recently about alcohol lowering the temperature of the body, and the late Dr. Parkes investigated this subject with his usual carefulness and accuracy. The following are some of his conclusions: "In healthy men who have been accustomed to take alcohol in moderate quantities the results are rather contradictory. In a man accustomed to alcohol, Ringer found no change; in two men, temperate, but accustomed to take beer and sometimes spirit, I could not detect any raising or lowering of the thermometer. Dr. Mainzer found no fall of temperature in trials on himself, but a slight fall in another healthy person. Some experiments by Obernier and by Follker are also quite negative. . . . We may conclude that the effect on temperature in healthy men is extremely slight; there is no increase, and in many persons no decrease. In those in whom there is a slight decrease the amount is trifling." It appears, therefore, that we have no sound scientific basis for the general assertion that alcohol in moderate quantity lowers the bodily temperature. It certainly does so, however, in very large doses. The following is the explanation usually given of the manner in which alcohol produces a reduction of the temperature of the body: It has two very marked effects on the organs of circulation. In the first place, it quickens the action of the heart—the heart under its influence beats with increased frequency and with additional force; in the second place, it relaxes the blood-vessels on the surface of the body, by paralyzing what are called the *vaso-motor* nerves, i. e., the nerves which control the condition of the walls of the blood-vessels as regards their state of contraction or relaxation. Alcohol thus leads to dilatation of the peripheral vessels, and the blood, therefore, under its influence flows freely to the surface of the body. Hence the comfortable warmth and the diffused glow which are felt soon after taking a dose of spirits, and hence the common practice of taking spirits to keep out the cold. But it is asserted that, instead of "keeping out the cold," this practice, under certain circumstances, may have the contrary effect of letting in the cold. For, as the blood is brought to the surface in greater quantity on account both of the dilatation of the vessels and the increased rapidity of the heart's action, it parts with its heat, by radiation from the surface, with greater readiness; and as the blood, cooled at the surface, is rapidly carried away into the interior of the body, the blood in the internal organs, and indeed the whole mass of blood in the body, becomes quickly reduced in temperature. This is the theory, but I am not aware of any experiment on record in which any noteworthy fall of temperature has been observed during this period of cardiac excitement; reduction of temperature is the characteristic of the stage of depression from alcoholic poisoning when the cardiac action is weakened. Nor need we conclude that the general experience of mankind as to the effect of a moderate dose of alcohol in conferring, for a

[1] Richardson on "Alcohol," Cantor Lectures, p. 73.

[2] Brunton: "The Physiological Action of Alcohol," the *Practitioner*, vol. xvi., p. 135.

time, upon the human organism a resisting power against the injurious influence of cold, is without foundation. The subjective feeling of warmth, which, under such circumstances, is universally admitted to occur, is not an unimportant fact; whereas, a slight lowering of the body temperature, even should it be proved to occur, is not inconsistent with perfect heath, provided no sense of chill accompanies it. It is a well-known fact that subjective feelings of warmth and chilliness are by no means wholly dependent upon, or proportional to, the actual temperature of the body as registered by the thermometer. In the shivering stage of ague, when the teeth are chattering and the subjective feeling of cold is intense, the thermometer often registers a body temperature six to eight degrees above the normal.

Now, before we accept the theory of the alcoholo-phobists that alcohol, in any dose, small or large, lessens rather than increases the power of resisting the injurious influence of cold, let us examine the question more carefully, for it has a most important practical bearing. When, on a bitterly cold night, we send out to our coachman a glass of hot brandy-and-water, are we running a great risk of having him laid up with inflammation of the lungs the next day? When the country doctor is summoned, on a cold night, out of his warm bed to take a drive of four or five miles in the teeth of a cold east wind, is he running increased risk of taking cold by drinking a tumblerful of mulled claret before he starts?

In order to answer these questions satisfactorily, we must ask another question. In what way does exposure to cold affect us injuriously? And it must always be remembered that I am not referring to continuous exposure to the cold of the arctic regions, but to such temporary and occasional exposure as is common in a changeable temperate climate like our own. In order to answer the question I have asked, I will quote two short passages from Huxley's well-known "Elementary Lessons in Physiology:"

"The feeling of warmth or cold is the result of an excitation of sensory nerves distributed to the skin" (p. 192).

"When exposure to cold gives a man catarrh, or inflammation of the lungs, or diarrhœa, or some still more serious affection of the abdominal viscera, the disease is brought about through the nervous system. The impression made by the cold on the skin is conveyed to the nervous centres, and so influences the vaso-motor nerves (as the nerves which govern the walls of the vessels are called) of the organ affected as to cause their partial paralysis, and produce that state of congestion (or undue distention of the vessels) which so commonly ends in inflammation" (p. 53).

It is clear, then, that if mischief arises from exposure to cold, it is due to an impression made on the peripheral nerves, and that the injury to deep-seated organs is usually caused by a reflex influence acting along the nerves of those organs. Now, when such injurious impression is made on the peripheral nerves, it is almost invariably remembered as a disagreeable feeling of chilliness. But, I contend, a moderate dose of any warm beverage containing alcohol, judiciously taken before temporary exposure to cold, does commonly tend to prevent this injurious impression, and it does so, in the first place, by quickening the circulation and so conveying the warm blood more freely and frequently through the cutaneous vessels, and secondly, by its tendency to relax the vessels of the skin, it counteracts the opposite tendency of cold, which is to constrict them, and so, by maintaining a free circulation of warm blood over the surface of the body, the sensitive extremities of the peripheral nerves remain bathed, as it were, in warm fluid, instead of being starved and chilled, through constriction of the blood-vessels, by the external cold.

It is argued, and, to a certain extent, no doubt truly, that the contraction of the vessels of the surface by cold is a natural conservative effort by which the blood is kept from coming to the surface of the body, and there parting with its heat by evaporation, etc. But, apart from the fact that in a very cold atmosphere little heat can be lost by evaporation, it is pretty well known that the so-called conservative processes of Nature prove often very indiscriminating processes, and, in this particular instance, it is precisely when this process reaches an extreme degree that the baneful effects of chill are produced; and it would seem that, in the careful and moderate use of alcoholic beverages, we have an agent that will help us to resist this extreme degree of Nature's conservatism.[1]

[1] Dr. Brunton, with whose observations on "The Physiological Action of Alcohol" I, in the main, agree, makes the following judicious remarks on the point discussed above:

"While alcohol is thus injurious during *prolonged* exposure to cold, the case is very different after the exposure is over, and its administration may thus be very beneficial. Supposing a man, after being out all day, comes home much chilled to a warm fireside. He stands before the grate and turns himself round and round, but he cannot get himself warmed through. The cutaneous vessels so long contracted by the cold will not relax all at once, and the deeper tissues gain heat very slowly, just as they very slowly lose it by mere conduction through the skin. If a little spirit

Another question of the greatest practical importance in connection with the alcohol controversy is this: Does the use of alcohol increase the bodily strength? does it increase our capacity for exertion, muscular or mental? does it, if taken when the body is fatigued, fit us for renewed effort? This is a question of great interest to a great diversity of persons—to the sportsman as well as to the student, to the military commander and to the employer of labor, to the sedentary man of business as well as to the trained athlete.

An interesting contribution to the solution of this problem is the report by Dr. Parkes, "On the Issue of a Spirit Ration during the Ashantee Campaign."

"When," he asks, "as so frequently happens in campaigns, soldiers are marching nearly the whole of the day, and can obtain their regular food only late in the evening, what can be given to lessen the sense of great fatigue, and to enable them not only to continue the march, but to be ready for any emergency which may arise? The usual resort is to a spirit ration, and there is no doubt that, for a time, this exerts a reviving effect. But is it the best thing which can be given, and are its advantages without alloy? The first effect of alcohol, when given in a moderate dose, is reviving; but this effect is transient. The reviving effect goes off after, at the utmost, two and a half miles of additional march, and sometimes much before this. . . . It is clear, then, that alcohol is not a very trustworthy aid; for, supposing that a commanding officer, having marched twelve or fourteen miles, finds his men weary, and, not being able to halt and feed them, orders an issue of spirits of an amount sufficient to revive but not to depress. The first effect will be good, but in less than an hour his men will be as weary as before, or probably more so. If he then reissues the spirit within so short a period of time, it is certain that, in the case of many men—perhaps the majority—the marching power will be lessened. . . . It appears to me, therefore, that spirits, as an issue, should be kept for emergencies, as when, after great fatigue, a sudden but short exertion is required, or when, a march being ended, there is great depression and failure of the heart's action."

Sir Anthony Home, who was principal medical officer on the Gold Coast, speaks as follows:

"Men cannot keep in health on poor, insipid, badly-cooked rations. Under these circumstances I believe that, after their day's work, rum is desirable (beer and wine are impossible of attainment). There is a moment in which we may so keep up the system of a man tired to death by over-exertion as to bridge over the period in which lassitude ends in the beginning of disease. Good food will probably do this best, but it is rarely at hand when wanted; and, even if it were, the digestive functions participate in the general lassitude, so that neither digestion nor assimilation goes on sufficiently. At this time a glass of beer or rum sends the machine on again."

Dr. Parkes gives also some results of experiments on the effect of rum on men making long marches in this country. His object was to compare its reviving and sustaining effects with those of meat-extract and coffee. As I shall explain hereafter, my own view is that the best effects would be produced by combining these latter with a small quantity of spirit. A few brief extracts from the evidence of the men themselves will best serve my immediate purpose. One says: "After the rum [1] he felt a decided reviving effect; it gave him a spurt. This was not lasting." Another says: "On the first day, after the first dose, felt at first much revived; felt easy and marched better; after two miles felt thirst, and then got weak; the good effect of the rum had passed off." A third says: "The first dose of rum seemed to quicken his appetite and increase his thirst; for about two miles or so felt lighter and revived, and as if he could have jumped over a five-barred gate with all his accoutrements on; then this effect entirely went off, and he felt as tired as before." All three men preferred the meat-extract.

Mr. R. E. Carrington, of Guy's Hospital, who has published an excellent paper on "Alcohol" in the *Guy's Hospital Gazette*, calls attention to the habits of the Cambridge crew when training, as he says, for

"Perhaps one of the severest tests of muscular power that can possibly occur. I find the system pursued to consist of good hours, a moderate amount of good, wholesome food, a moderate amount of stimulants, with plenty of exercise. The stimulants may consist of a pint of beer for dinner and

be now taken, and especially if it be taken hot, the cutaneous vessels dilate, allow the blood to circulate through them, and become warmed by the fire; it returns warm to the internal organs, and soon the whole body is in a pleasing glow. At the same time the dilatation of the cutaneous vessels opens new channels to the blood which has been pent up in the interior of the body, and thus lessens any tendency to congestion or inflammation of internal organs, so that a glass of hot brandy-and-water at the proper time may possibly prevent a bronchitis or pleurisy." He also goes on to admit that there are circumstances under which alcohol may be beneficial "even while the exposure continues."—*The Practitioner*, vol. xvi., p. 132.

[1] They had already marched thirteen and a quarter miles.

a similar quantity for supper. A glass or two of good port or sound claret are generally taken during the day. Even champagne is given. Spirits are against all regulations, and are never given, for it is found they do not tend to strengthen in any way. It is found, then, that a regimen like this . . . is the one most calculated to call forth the best strength of the men."

It would seem, therefore, to be capable of demonstration, that the daily consumption of a moderate amount of alcoholic beverage is consistent with the most perfect development of muscular energy. It is also clear that a moderate dose of alcohol enables a man to put forth a sudden spurt of muscular effort. But it is also clear that if it be taken by itself it does not long sustain muscular strength. It rather enables a man to draw upon his reserves of strength than to produce new energy. But if it can be combined with something which will also sustain—as meat-extract, or meat-soup, or coffee, tea, or milk —it may prove most valuable in tiding over that shorter or longer period before these sustaining foods can take effect. It is especially useful when a short and sharp effort has to be made before a prolonged rest, since its stimulant effect is followed by a sedative one. Unlike some other stimulants, such as tea and coffee, it brings in its wake that greatest of all restorers, sleep. With regard to the effect of moderate doses of alcohol on mental work much difference of opinion exists. Many students find that, instead of helping them in their work, it hinders them. It dulls their receptive faculties. Others, on the contrary, find real help in moderate quantities of wine. These differences of effect would seem to depend greatly on differences in constitutional temperament. It is certainly capable, for a time, of calling some of the mental faculties into increased activity. Some of the best things that have ever been said have been said under the influence of wine. The circulation through the brain is quickened, the nervous tissue receives more nourishment, the imagination is stimulated, and ideas flow more rapidly, but it is doubtful if the power of close reasoning be not always diminished. It is useful for reviving mental power when from accidental circumstances, such as want of food, etc., it has been exhausted, but it should never be relied upon as an aid to continuous effort or close application.

The third and last point which I shall have space to consider under the general properties of alcohol is whether it does or does not promote digestion. Under certain conditions it certainly does. It is a physiological fact that when a small or moderate dose of alcohol comes in contact with the mucous membrane of the stomach it promotes the secretion of the gastric juice. And when the system is fatigued and overworked, and particularly when the mind has been especially engaged, and the other organs have been inactive, some stimulant is often needed to excite the gastric circulation, and to promote the secretion of the digestive juices. A jaded, overworked man of business comes appetiteless to his dinner; a dessert-spoonful of brandy will often induce appetite, and enable him to enjoy and digest his dinner, and no harm will come of it, unless it becomes a frequent habit. A distinguished medical teacher and physician of this town tells me that, after an exhausting day of teaching-work, he frequently finds he has no appetite for food until he has taken a glass of sherry. I have less hesitation in thus calling attention to the aid which alcohol occasionally gives to the stomach when taken judiciously, since I shall have occasion by-and-by to show how, when habitually taken in excess, it utterly destroys the digestive power.

I now proceed to pass in review the various beverages which we commonly drink in this country, into which alcohol enters as a constituent. The distilled spirits chiefly used in England are—brandy, containing fifty to sixty per cent. of alcohol; gin, forty-nine to sixty per cent.; whiskey, fifty to sixty per cent.; and rum, sixty to seventy-seven per cent. Of all these whiskey at the present moment enjoys the greatest share of popularity; the only reason for this that I know of is, that good whiskey costs less than good brandy, and that it is generally believed to be less subject to falsification than other spirits. Its flavor is also more agreeable to many persons than that of brandy. One of our highest authorities on this subject thinks, however, that whiskey "is inferior in delicacy to good brandy," [1] and

[1] Dr. Druitt: "More Notes on Wines and Spirits," *Medical Times and Gazette*, 1875 and 1876.

This writer goes on to say: "As for the poor old decrepit creatures who are past work and past hope, but who want to make their hearts beat a little more lively, they take their little glass of gin—perhaps "three-ha'porth"—and who is to blame them? Certainly it is not for the well-fed philanthropist nor the rich and luxurious invalid, who can command every comfort, to throw derision and scorn at the poor old gin-drinker. Really it would seem as if common-sense and chemistry lost their hold upon the mind of every one who writes against gin. Any one who knows practically the use and abuse of spirits, knows that the best way of making the drinker satisfied with a small quantity is to flavor it strongly with aro-

he calls attention to the fact that all brandy in the ordinary market is colored with burned sugar, and adds very pertinently, "Considering that our reason for using brandy (instead of wine) is to get rid of the saccharine and other substances requiring digestion, it seems highly inconsistent to add sugar to the spirit just to please the eye." He points out also the importance of using an unsweetened and uncolored spirit in a particular disease where sugar is inadmissible. "The Englishman likes his veal white and his brandy dark; but both are better without any tampering with their color. I have had some myself (i. e., pure, colorless brandy) from the house of Boulestin of Cognac." Rum is very little drunk among the upper classes in this country. It has, however, a fair share of popularity among the poor. It is the spirit which is used in the army and navy. Its peculiar flavor is due to the presence of butyric ether, of which it contains a considerable quantity. Gin is also more popular among the poor than among the rich. It was originally a medicine, and under the designation of spirit of juniper has appeared in every pharmacopœia for the last two hundred years. It is the spirit of all others which, in this town, is especially subject to falsification. But there is a spirit called Plymouth gin, distilled in the town of Plymouth, which is very pure and wholesome, quite as much so as whiskey, and it is, I believe, a little cheaper.

The use of wine as a beverage has greatly increased during the last sixteen or seventeen years in this country. Since 1859 the imports from Portugal have doubled, those from Spain trebled, and those from France increased tenfold. Now, seeing that the production of the best wines is strictly limited, we may safely infer that there is more bad wine in this country at present than at any previous time. The best qualities of wine are without doubt the most wholesome of all alcoholic beverages. The alcohol that exists in them is modified by its combination with the delicate ethers and other constituents found in all well-fermented high-quality wines that have been long in bottle. A great physiological authority has said that the effects of all alcoholic drinks depend entirely upon the quantity of alcohol they contain, and that equivalent quantities of pure alcohol would produce identically the same effect. Now, it is simply impossible that this reasoning can be sound. To make it sound it would be necessary to compare the effects of every kind of alcoholic beverage (including ginger-beer, which is an alcoholic drink, though a very weak one) in a number of distinct cases, and under varying circumstances, with the effects of exactly an equivalent quantity of pure alcohol. This alone could justify a sweeping general conclusion such as I have quoted. But the results of such observations and experiments as have been made are to the contrary effect. It would really seem as though the alcoholo-phobists thought any argument good enough to throw at the head of alcohol. Take the following: "Dr. Smith found that the amount of carbonic acid (eliminated under the influence of alcohol) was reduced in men, as I have found it in the lower animals, so that the fact of the general reduction may be considered as established beyond disputation."[1] If this be so, then I say many alcoholic beverages act differently from an equivalent quantity of alcohol, and Dr. Smith shall himself bear testimony to the fact. He found,[2] with regard to ardent spirits, that "some increase and others decrease the amount of carbonic acid expired." In one case (with alcohol) there was an average increase of expired carbonic acid per minute 0.18 and 0.8 grain, on two occasions. In another case, average increase of carbonic acid expired 0.74 grain per minute. In a third case, with rum, there was an average increase 0.26 grain per minute. In a fourth case, with very fine old rum, maximum increase 0.1 and 1.5 in two persons. In other cases, with three ounces of sherry, he observed an average increase of 0.19 and 0.3; with half a pint of Dublin stout increase 0.85 and 0.81 grain; with half a pint of fine old ale, increase 0.6 and 0.27 grain per minute. One is inclined to ask what is evidence worth when a man has it all his own way? What is evidence worth without cross-examination?

I need hardly say that those who know anything practically about wines (and the only way of knowing wines is by drinking them; a physiologist or a chemist who drinks water only can know very little about the different effects of different wines) are quite agreed that the effect of a natural wine may be very different from that of an equivalent quantity of alcohol. I have myself observed recently two remarkable instances which support this statement. Two gen-

matics, so that the stomach may be gratified quickly without any quantity of spirit in excess. We are told that gin contains oil of juniper, oil of bitter-almonds, potassa, alum, nitric acid, oil of vitriol or sulphuric acid, and butyric acid. Chemistry stands aghast at such a description; still more so does the cause of true temperance—for what good cause was ever carried by exaggeration?"

[1] Richardson: Cantor Lectures, p. 72.
[2] Proceedings of Royal Society, 1859.

tlemen, suffering at different periods from the same kind of local imflammatory affection, which every kind of alcoholic beverage aggravated, accidentally drank some very fine Château Margaux that had been many years in bottle; in both instances not only was there no local irritation produced by two or three large glasses of the wine, but the general refreshing influence it exercised on their condition of depressed health was most marked. In neither of these cases could half a glass of sherry be borne with comfort.

The original quality of a wine, its freedom from admixture with added alcohol or other substances, and its maturity, are the conditions which determine its action on the human organism. It is exceedingly likely that the purely exhilarating effect of certain fine old wines, when taken in moderate quantity, may be due to the circumstance that some of the natural constituents of the wine, combined with the alcohol, determine the complete decomposition of the latter into simple elements or its rapid elimination after its stimulating effects have passed away; so that no undecomposed alcohol and no secondary products of its decomposition, such as acetic acid or aldehyde, remain in the organism. Analogous instances certainly occur in the use of other narcotic substances. Opium taken by itself has a very different and far more disagreeable effect than when combined with salts of ammonia or other substances which excite the action of the secreting organs. It is the same with the hydrate of chloral. Taken by itself it often produces much headache and drowsiness after its soporific effects have passed away; but, when combined with an equal quantity of bromide of potassium, a medicine which acts as a stimulant to certain organs of secretion, the unpleasant consequences are generally wholly obviated.

It must not be expected that cheap wines can be good wines. There are a great number of persons always ready to give good prices for good wines. Cheap wines are either fabricated wines, and therefore unwholesome, or they are poor, acid, flavorless, natural wines that will not keep. The latter may not always be unwholesome, especially if their excess of acidity be corrected by admixture with effervescing alkaline waters; but they possess none of the generous, exhilarating properties of good, sound wines. So recently as last year the respectable wine-merchants of Paris, Bordeaux, and other towns, petitioned the French Legislature to interfere and put a stop to the wholesale fabrication of red wines. They stated that it was becoming so common a branch of industry to take a barrel of sour white wine, and, by means of artificial coloring-matters, to convert it into a brilliant red, salable article, that the credit and reputation of the French wines were likely to be seriously affected by it.

The best and most wholesome wines for general use as beverages are the good, sound, matured wines of Bordeaux and Burgundy. The finer and older the wine, the more perfect will be its tonic properties. As very light, refreshing beverages, containing but a very small percentage of alcohol, there are some kinds of hock and still Moselle to be obtained at very moderate prices. The sparkling wines of Champagne are preëminent for their rapid stimulating effects. No beverage proves of greater value, under certain circumstances, than a draught of champagne. It is especially useful in convalescence from some acute diseases, and I have known it prove most helpful under certain conditions of prolonged mental strain. Indeed, the genuine, light, sound wine of Champagne can be easily distinguished by its effects from the spurious imitations. These often produce depression, and never the peculiar buoyancy of true champagne. In the case of very delicate stomachs, it answers best when mixed with an equal quantity of soda-water.

Of all the wines that are consumed in this country, port and sherry stand responsible for producing the greatest amount of mischief. An incalculable amount of evil is wrought by sherry, and especially by the so-called dry sherries. Ever since it has been the fashion to prefer dry sherries, dried sherries have been provided in abundance. Most sherries (and ports also) are made-up wines, and contain, roughly speaking, about twice as much alcohol as other wines; but, of all made-up wines, the made-up dry sherry is the most pernicious. Nor have they even the merit of being cheap, for many of them are sold for high prices. The dryness is given them by nitrous ether—a horrible and bad imitation of the amontillado flavor — sulphate of lime, tannin, alum, and other atrocities. Now this falsification would not be practicable if men who ask for dry sherries (and the same remark applies to many of the so-called dry champagnes) understood what is the real meaning of the word "dry" applied to wines. It simply means a wine free from added spirit or sugar, and in which the natural saccharine matter of the grape has undergone a more or less complete fermentative destruction. It is a negative, not a positive quality. It means the absence of sweetness, and not the

addition of something which shall give the wine a positive quality of dryness. In every case, a good sherry is soft to the mouth, and when a sherry leaves in the mouth a sense of dryness, and the tongue or palate rough, it is perfectly certain that you are not drinking a natural dry wine, no matter what price you have paid for it. Now, these astringent matters added to sherries are exceedingly unwholesome, for, besides the hurtful qualities of the original bad wine to which they are added, they tend to diminish the activity of the secreting organs, and so retain in the blood the pernicious compound of which they form part. The following remarks on dry sherries are taken from one of a series of letters on "Spanish Vineyards," etc., published in the *Pall Mall Gazette*, in October and November, 1875:

"Four different kinds of dry Jerez wines are shipped to England: natural wines, understood to contain no added spirit; vintage wines, the produce of individual vineyards, and occasionally of specific years; solera wines, such as fine amontillado and olorosa; and, finally, blended wines. The natural wines of which I speak are not the wines commonly advertised in England at low rates under that designation. Jerez wines, perfectly free from spirit, cannot possibly be sold cheap in England, because they require to be at least five years old; whereas the wines offered as natural are generally young, unripe wines, whose fermentation has not yet terminated, and which come far more frequently from Seville or La Mancha than from the Jerez district. Such wines are necessarily unwholesome, for heat revives the fermentative action, which completes itself in that delicate organism —the human stomach."

The poor man's ideal of wine is port. It is sweet, it is fiery, and it has a good, rich color! But, of all the hurtful mixtures that are sold to the poor man, public-house port is, perhaps, the worst. I need not enumerate the various substances with which it is adulterated, but many of these are astringents, and check the action of the secreting organs. Good, sound port is useful in some forms of illness, but its palatableness makes the poor much too eager for it. A method of removing the attractiveness of port wine when given to the poor is amusingly described in those clever sketches of parsons' wives, published under the title of "The Owlet of Owlstone Edge." The particular parson's wife in question has strong educational tendencies of rather a stern quality; her husband is speaking to her about a poor invalid in the parish; she replies: "I sent him a pint of port, putting a lump of camphor in it by way of precaution." "Precaution, my lamb?" exclaims the astonished parson. "Yes; nobody will drink port wine for pleasure that has camphor in it. It is just beastly as a beverage, though extremely wholesome!"

Beer contains less alcohol and less acid than wine; but it contains a variety of other substances, such as sugar, cellulose, dextrine, albuminous matters, etc., held in solution or suspension, which render it especially prone to further fermentation and decomposing changes; and though the presence of these starchy, saccharine, and other matters, may make it a more sustaining beverage to the hard-working man, it renders it quite unfit for the use of delicate stomachs, especially where there is any tendency to gouty malassimilation. Beer is essentially a fermented infusion of malt, and the addition of hops to beer was an after-thought, the credit of which is given to the German monks of the eleventh century. Hops were added for the purpose of giving it aroma and for preserving it from decomposition. For many centuries this German hop-containing beer was imported in large quantities into this country, to the extent of 800,000 barrels a year.[1]

Before the introduction into England of tea and coffee, beer was much more largely consumed by the upper classes, and especially by ladies, than it now is, and the same remark probably applies to the consumption of animal food—two circumstances which may, to a certain extent, account for the gouty inheritance which has been handed down to so many of us. Sound beer, in which the fermentation is thoroughly complete, is a useful beverage in moderate quantity for healthy persons who lead an active or laborious life in the open air. It is useful, too, in small quantities, for delicate, under-nourished children, and should be taken with their meals. It will often help them to grow fat more quickly than cod-liver oil. It is, however, a most frequent cause of troublesome dyspepsia in persons of sedentary habits, and this is especially the case with the commoner kinds, which have probably not ceased to ferment, and which are sold, often in an adulterated form, to the

[1] England is now the largest beer-producing and beer-consuming country in the world. Its annual produce exceeds 880,000,000 gallons, and of this scarcely two per cent. is exported. Germany produces (1872) about 616,000,000 gallons, and of this it is calculated that Southern Germany consumes four times as much as Northern Germany. Austria produces 264,000,000. North America 242,000,000. France and Belgium about 154,000,000 each. Paris, it is calculated, consumes only from 4,400,000 to 6,600,000 gallons of beer annually, compared with 66,000,000 to 88,000,000 gallons of wine. —(*Vide* M. Radau, "La Science et la Fabrication le la Bière," *Revue des Deux Mondes*, November 15, 1876.)

poor. It is important also to remember that beer in large quantities is certainly a depressant, and that no greater mistake can be made than to give it freely to laboring-men while at work with the view of strengthening them. Bearing on this point, Dr. Parkes gives a very interesting account of the use of a drink of thin boiled oatmeal during some extremely heavy work lately performed on the Great Western Railway during the change from the broad to the narrow gauge:

"It was necessary to take up and relay the rails in the shortest possible time, and the same men were obliged to be kept at work for many hours (sometimes eighteen hours in the day). The summer days were chosen, so that almost literally the men worked night and day, stopping only for meals and a little sleep. They took their ordinary meals, and beer with their meals if they pleased, but during the long periods of the work they were supplied with nothing but a drink of oatmeal boiled in water, and beer and spirits were prohibited. Each man had an allowance *per diem* of one pound of oatmeal and half a pound of sugar, and so important was this deemed that a man was told off specially for every twenty men, and was solely employed in boiling and taking the oatmeal-drink to the men. This liquid was drunk in large quantities, and was most highly approved of. The character of the work and the temper of the men were much better, in the opinion of the engineers, than would have been the case if beer and spirits had been issued."[1]

In speaking of the use of alcoholic beverages I have frequently had to employ the word "moderate," and the question may well be asked, "What does this word mean?" It has been calculated that the daily consumption of an ounce and a half of absolute alcohol is the limit of moderation for a strong, healthy man, and this will correspond pretty nearly with three ounces of brandy (i. e., rather less than the third of half a pint), rather less than half a pint of the stronger wines, such as port and sherry, rather less than a pint of the weaker wines, such us claret and hock, and a pint and a half of beer.

The non-alcoholic class of stimulating beverages must now receive a brief consideration. There exists some doubt as to the precise date when the use of tea, coffee, and chocolate, became general in this country. In "Pepys's Diary" there is the following entry under September 25, 1661: "I sent for a cup of tea (a Chinese drink), of which I had never drunk before." And Isaac Disraeli states that he had heard of Oliver Cromwell's teapot in the possession of a collector. In 1660 the price of tea is stated to have been sixty shillings the pound, and it does not seem to have been introduced into general use until the beginning of the eighteenth century. Its adoption as a popular beverage was strenuously opposed by many. "In Germany, Hahnemann considered tea-dealers as immoral members of society, lying in wait for men's purses and lives."[1] He was equally opposed to the use of coffee. "Hahnemann se désolait de l'abus que ses compatriotes faisaient du café. Il lui reprochait d'avoir altéré le carac, tère national, détruit la solidité du jugement, la fermeté de volonté chez le peuple allemand, pour ne lui laisser que de la loquacité, de la vacillation et de la mobilité fugitive!"[2] In an article on Duncan Forbes in the *Edinburgh Review*, of 1816, the writer, alluding to the fact that Duncan Forbes had presented to the Government a scheme for punishing the use of tea, likens the progress of this famous plant to the progress of truth—"suspected at first, though very palatable to those who had courage to taste it; resisted as it encroached; abused as its popularity seemed to spread; and establishing its triumph at last, in cheering the whole land, from the palace to the cottage, only by the slow and resistless efforts of time and its own virtues."

But it must be admitted that the abuse of tea and coffee may be attended by serious injuries to the human organism. The pernicious effect of the active principle of coffee—caffeine, which is identical with theine, the active principle of tea—on certain animals is well shown in an elaborate paper by Dr. Leven, which I have already mentioned. He found that one to ten centigrammes of caffeine acted as a fatal poison when given to frogs, first quickening the action of the heart and the respiratory organs, and then inducing a tetanic state. To Guinea-pigs fifteen to twenty centigrammes proved fatal, first increasing the action of the heart, which in one instance was so rapid that the pulsation could not be counted, and then followed by paralysis of that organ. The same results were obtained with rabbits. One gramme given to a dog did not prove poisonous; it increased the activity of the heart and the respiratory and secretory organs, but after three or four hours the symptoms disappeared.

M. Leven, in short, established as the result of his experiments that the active principle of

[1] Parkes: "On the Issue of a Spirit Ration during the Ashantee Campaign."

[1] Disraeli's "Curiosities of Literature."

[2] Docteur M. Leven: "Action Physiologique et Médicamenteuse de la Cafeine," *Archives de Physiologie*, 1868.

coffee acts first on the heart, and quickens the circulation and respiration, and that in the second place it increases the tension of the blood-vessels—an effect, it will be noticed, precisely the opposite of that of alcohol, which diminishes the tension of the vessels. It irritates the nervous centres, the brain and spinal cord, and also the nerves themselves. "It excites the nerve-cells," says M. Leven, "not only by its stimulating effect on the circulation, but also by a special excitant action due to the caffeine itself." The results of M. Leven's physiological experiments correspond precisely with the symptoms which have been observed to occur in consequence of excessive indulgence in tea or coffee. Coffee contains seventeen per cent. of caffeine, and it is reckoned that in the quantity daily consumed by an ordinary Parisian there is enough to poison five Guinea-pigs! M. Leven quotes the case of a young medical man who suffered from coffee-intoxication. For six months he had taken five or six cups of coffee daily. He experienced violent palpitations, tremblings in the arms, cramps in the legs, a convulsive cough, and permanent contraction of the pupils. When he discontinued the use of coffee these symptoms disappeared.

I have, again and again, had occasion to observe the characteristic symptoms which the abuse of tea and coffee produces. The most common are distressing persistent palpitations, an irritable, excited state of the nervous system, a sense of dread of impending calamity, throbbings in the head and sometimes an approach to giddiness, inability to sleep, obstinate dyspepsia—only to be relieved by abstaining from its cause. I believe it is the experience of most hospital physicians that a very large proportion of the cases of dyspepsia which crowd the out-patient rooms of the London hospitals are induced by the constant large consumption of tea by the poor. The disturbing effect of abuse of tea on the action of the heart was not likely to escape the notice of so acute an observer as Dr. Stokes, of Dublin; and in his work on diseases of the heart he calls attention to the following, among other cases: A gentleman of great intellectual attainments had been in the habit of passing a great part of the night in literary and scientific labors; during the evening and through the night he was in the habit of drinking largely of tea, without any thought of its doing him harm. At length he became subject to paroxysms of quick and vehement action of the heart, accompanied by intense distress and oppression, with a painful sense of impending death. He became greatly depressed in spirits, and believed he should die in one of these dreadful paroxysms. On examination after the paroxysm had passed off, his heart was found to be perfectly sound. But a very curious affection of the nervous system became permanent. He found the greatest difficulty in walking on level ground; he had an irresistible feeling that he should slip and fall; and on one occasion, wishing to visit a friend who lived near him, after many ineffectual attempts to walk on the level, he actually proceeded to his friend's house on all-fours.

I have already alluded to an antagonism which I believe to exist between the effects of tea and coffee on the one hand, and those of alcohol on the other. They both excite the heart to increased action, but the excitement produced by alcohol rapidly passes away and leaves a state of calm or (if the dose has been large) depression, and hence its tendency to promote sleep; tea and coffee also excite the heart, but the excitement produced by these beverages does, in many cases, leave behind it a state of irritability instead of calm, and hence their tendency to prevent sleep. Alcohol relaxes the blood-vessels, and so diminishes vascular tensions; coffee and tea increase vascular tension. Alcohol, in its secondary effect, soothes the nervous system; tea and coffee irritate the nervous system. It is a well-known fact that a cup of strong tea or coffee dispels the effects of slight excess in wine; it is, perhaps, not so well known that a few teaspoonfuls of brandy or a glass or two of sherry will remove the nervous irritability produced by tea or coffee. I fear much of the "sly drinking" on the part of women is induced by states of nervous irritability originally excited by over-indulgence in tea. The practical issue of all this is, that excessive indulgence in any stimulant, whether alcoholic or non-alcoholic, is most hurtful. Of the grateful, refreshing, and invigorating properties of tea and coffee taken in moderation, and occasionally rather than habitually, no one can be more sensible than I am; but I am convinced that if a stimulant is needed, as it often is by men of business under occasional pressure of work, the best results will be obtained by taking the bane and the antidote together—a small quantity of tea or coffee with a small quantity of an alcoholic beverage. When what I have termed tea-dyspepsia is produced, the only plan is to leave off drinking that beverage for three or four months, after which its use may often be resumed with impunity. Chocolate is a very useful substitute for tea or coffee, but it does not possess the property

of immediate stimulation to anything like the same degree.

It will not be expected that I should speak in this place of the use of alcohol in the treatment of disease, but there is another most important branch of the subject, and one of most serious public interest, which I have not yet alluded to, except incidentally; I mean the influence of excessive indulgence in alcoholic drinks as a cause of disease. What are the physical effects on the organism of the abuse of alcohol? In every large hospital in a great city like this many cases of serious and fatal disease are always to be found which owe their existence to intemperance. The general public are little aware of the enormous amounts of strong spirits which are consumed by some of the working-classes. Cabmen, Covent Garden and dock laborers, the inferior class of lawyers' clerks, and compositors, are among the worst offenders. I will mention two instructive instances: A cabman applied as an out-patient to King's College Hospital, suffering from a grave form of disease the result of spirit-drinking. "You drink hard?" said the doctor. "Pretty fair," said the cabman. "What do you drink?" "Whiskey, mostly." "How much whiskey a day?" "Can't say exactly, sometimes more, sometimes less." "But give us a rough average." "Well, I s'pose, one day with another, about a couple o' quarts a day." "But," exclaimed the doctor, "that would cost you eight shillings a day; how can you afford that?" "Oh!" answered cabby, "it ain't a matter of affordin' if a man gives his mind to it!" Now this quantity seemed so enormous that I mentioned the case to one of the inspectors of police at Great Marlborough Street, and he assured me that from his experience of cabmen he did not think the estimate excessive. The second case was that of a dock-laborer, also suffering from serious, irremediable disease caused by alcohol. The dialogue that ensued was to much the same effect: "What do you drink?" "Mostly whiskey." "How much a day?" "Well, I'm never the worse for liquor." "But how much a day?" "Well, perhaps about a pint a day, more or less." Now, here was a dock-laborer spending at least two shillings a day, that is fourteen shillings a week, on whiskey! and at middle age he becomes a charge on the charity of the public. Yet this man appeared when in the hospital to be an intelligent, well-disposed man. "He had taken the whiskey in his heavy work, thinking it would strengthen him."

It is this ignorance that we should strive to remove. We shall never cure the laboring-man of his intemperate habits by trying to force tea and coffee down his throat. Education, as Mr. Lowe has said, may be expected to do much to check intemperance; but it should be education in which a knowledge of the plain, simple laws of physiology and health has a place.

It must not be forgotten, in considering what is the true remedy for intemperance among the poor, that drunkenness is frequently the offspring as well as the parent of misery. Want of education, improvident marriages, dirty and unwholesome dwellings, are all of them directly and indirectly causes of intemperance; and if we would diminish habits of drunkenness among the lower classes, we should trust rather to the removal of influences such as these, than to the promulgation of exaggerated statements as to the baneful effects of the moderate use of alcoholic beverages.

—*The Fortnightly Review.*

A MODERN "SYMPOSIUM."[1]

THE INFLUENCE UPON MORALITY OF A DECLINE IN RELIGIOUS BELIEF.

SIR JAMES STEPHEN.—Many persons regard everything which tends to discredit theology with disapprobation, because they think that all such speculations must endanger morality as well. Others assert that morality has a basis of its own in human nature, and that, even

[1] A certain number of gentlemen have consented to discuss from time to time, under this title, questions of interest and importance. Each writer will have seen all that has been written before his own remarks, but (except the first writer) nothing that follows them. The first writer, as proposer of the subject, will have the right of reply or summing-up at the end. The present discussion will be continued and concluded in the May number of the *Review*.—EDITOR *Nineteenth Century*.

if all theological belief were exploded, morality would remain unaffected.

My own view is, that each party is to a considerable extent right, but that the true practical inference is often neglected.

Understanding by the theology of an age or country the theory of the universe generally accepted then and there, and by its morality the rules of life then and there commonly regarded as binding, it seems to me extravagant to say that the one does not influence the other. The difference between living in a country where the established theory is that existence is an evil, and annihilation the highest good, and living in a country where the established theory is that the earth is the Lord's and the fullness thereof, the round world and they that dwell therein, has surely a good deal to do with the other differences which distinguish Englishmen from Buddhists.

Even if it be said that such differences are merely a way of expressing the result of a difference of temperament and constitution otherwise caused, this does not diminish the effect of a belief in the truth of the theory. Kali, Bhowanee, and other malevolent deities worshiped in India, are probably phantoms engendered by fear work ing on a rank fancy; but this does not make the belief in their real existence less influential in those who hold it. A man who cuts off the end of his tongue to propitiate Kali would let it alone if he ceased to believe in her existence, though the temper of mind which created her might still remain, and show itself in other ways

The belief that the course of the world is ordered by a good God, that right and wrong are in the nature of a divine law, that this world is a place of trial, and part only of a wider existence —in a word, the belief in God and a future state —may be accounted for in various ways. Now that in this country (to go no farther) the vast majority of people believe these doctrines to be true, in fact, just as they believe it to be true, in fact, that ships and carriages can be driven by steam, and that their conduct is in innumerable instances as distinctly influenced by the one belief as by the other, appear to me to be propositions too plain to be proved.

On the other hand, it seems at least equally evident that morality has a basis of its own quite independent of all theology whatever. It is difficult to imagine any doctrine about theology which has not prevailed at some time or place; but no one ever heard of men living together without some rules of life—that is, without some sort of morality. Given human action and human passion, and a vast number of people all acting and feeling, moral rules of conduct of some sort are a necessary consequence. The destruction of religion would, I think, involve a moral revolution; but it would no more destroy morality than a political revolution destroys law. It would substitute one set of moral rules and sentiments for another, just as the establishment of Christianity and Mohammedanism did when they superseded various forms of paganism.

It would be scarcely worth while to write down these commonplaces, if it were not for the sake of the practical inference. It is that theology and morality ought to stand to each other in precisely the same relation as facts and legislation.

No one would propose to support by artificial means a law passed under a mistake, for fear it should have to be altered. To say that the truth of a theological doctrine must not be questioned, lest the discovery of its falsehood should produce a bad moral effect, is in principle precisely the same thing. It is at least as unlikely that false theology should produce good morals as that legislation based on a mistaken view of facts should work well in practice

I will give two illustrations of this—any number might be given: Suicide is commonly regarded as wrong; and this moral doctrine is defended on theological grounds, which are summed up in the old saying that the soldier must not leave his post till he is relieved. I will not inquire whether any other argument can be produced forbidding suicide to a person laboring under a disease which converts his whole life into one long scene of excruciating agony, and which must kill him in the course of a few useless months, during which he is a source of misery, and perhaps danger, to his nearest and dearest friends. I confine myself to saying that, if it could be shown that there is no reason to suppose that God has in fact forbidden such an act, its morality might be discussed and decided upon on different grounds from those on which it must be considered and decided upon on the opposite hypothesis.

Take, again, the law of marriage. Suppose a man's wife is hopelessly insane—ought he to be allowed to marry again? Ought divorce to be permitted in any case? These questions will be discussed in a very different spirit, though it is possible that they might be answered in the same way, by persons who do and by persons who do

not believe in sacraments, and that marriage is a sacrament.

Now, let us suppose for the sake of argument that it could be shown that, if all theological considerations were set aside, it would be desirable that a person dying of cancer should be permitted to commit suicide, and that a man whose wife was incurably mad should be allowed to marry again; and that, on the other hand, if theological considerations were taken into account, the opposite was desirable. Upon these suppositions the question whether the theological beliefs which make the difference are beneficial or not will depend on the question whether they are true or not. Applied generally, this shows that the support which an existing creed gives to an existing system of morals is irrelevant to its truth, and that the question whether a given system of morals is good or bad cannot be fully determined until after the determination of the question whether the theology on which it rests is true or false. The morality is good if it is founded on a true estimate of the consequences of human actions. But if it is founded on a false theology, it is founded on a false estimate of the consequences of human actions; and, so far as that is the case, it cannot be good; and the circumstance that it is supported by the theology to which it refers is an argument against, and not in favor of, that theology.

LORD SELBORNE.—I begin by observing that (putting special cases aside, and looking at the question in a general way) morality has not flourished, among either civilized or uncivilized men, when religious belief has been generally lost, or utterly debased. Not to dwell upon the case of savage races, the modern Hindoos and Chinese have long been civilized, but are certainly not moral; nor can anything worse be conceived than the morality of the Greeks and Romans, at the height of their civilization. The morality of the Romans, in the old republican times when they knew nothing of Greek philosophy, was praised by Polybius, who connected it, directly and emphatically, with the influence among them of religious belief. After their intellectual cultivation had taken its tone from the irreligious or agnostic materialism of Epicurus (hardly distinguishable, I think, from that sort of philosophy which some persons think destined to supplant religious belief in the present day), their morality became what is described in the first chapter of the Epistle to the Romans and in the Satires of Juvenal; nor does it seem to have been worse than that of the other civilized races on the shores of the Mediterranean, over whom, at the same time, religion had equally lost its influence.

On the other hand, it seems to me certain, as an historical fact, that the place which the principles of love and benevolence, humility and self-abnegation, have assumed in the morality of Christian nations (with a wide-spreading influence which has been advancing till the present time with the growth of civilization) is specifically due to Christianity. To Christianity are specifically due—1. Our respect for human life, which condemns suicide, infanticide, political assassination, and I might almost say homicide generally, in a way previously unknown, and still unknown where Christianity does not prevail; 2. Our recognition of such moral and spiritual relations between man and man as are inconsistent with the degradation of women, and with the practice of slavery; 3. Our reverence for the bond of marriage; and, 4. Our abhorrence of some particular forms of vice. I do not mean to deny that traces of a state of opinion, more or less similar upon some of these points, are discoverable in what we know of the manners of some non-Christian nations; but it is historically true to say that the prevalence of each of these principles, as manifested among ourselves, is specifically due to Christianity. Of Christianity I speak in a sense inclusive of all that it derives from the antecedent Jewish system; of which it claims to be the true continuation and development.

If freedom of inquiry is not to be stopped, after the rejection of religious belief, it must gradually extend itself to the whole circle of morality, most, if not all, of which is as little capable of demonstrative proof through the evidence of the senses as any of the doctrines of religion. Those who reject religion will not voluntarily submit to moral restraints founded upon the religion which they reject, unless they can be placed upon some other intellectual basis, sufficiently cogent to themselves to resist the attractions of appetite or self-interest. That large part of mankind who are always too much under the government of their inclinations and passions will be quicker in drawing moral corollaries from irreligious principles than the philosophers by whom those principles are propounded; and the advanced posts of morality, in which the influence of religion culminates, and of which the necessity may not be so evident on natural or social grounds, are not likely to be very strenuously defended by those philosophers themselves.

If the religious foundations and sanctions of morality are given up, what is to be substituted for them?

First: will the modern notion of a duty to act so as may conduce to the greatest happiness of the greatest number of men be sufficient? I think, certainly not. The idea of duty is not, to my mind, practical or intelligible without religious conceptions; and this particular conception of duty depends entirely upon a test extrinsic, and not personal, to the individual—a test, too, which it is difficult (not to say impossible) for each individual to verify for himself; though it may be verified, to their own satisfaction, by philosophical students of casuistry or political economy. Those motives are of necessity strongest which directly concern the man himself: and a moral principle which attempts to counteract influences operating directly and immediately upon the will by others which are speculative and remote, without any higher sanctions realized by and reacting upon the individual, must necessarily be weak.

But, secondly: will this idea be sufficient, if so modified as to present to the man the pursuit of his own happiness in this world as the rule of life, but teach him to discover it by observing and doing those things which most conduce to the happiness of men in general? In this form it is older and more plausible; but the difficulties of making it practical are really very much the same. This doctrine, as Aristotle observes, depends upon a general induction: it deals only with general truths and general conclusions, to which there are many apparent and (if there were no law of moral retribution and adjustment behind) many real exceptions. The foundations of a man's moral character and habits must be laid in his youth: when (as Aristotle also says) he is inexperienced, naturally inclined to follow his passions, and not predisposed to accept the disquisitions of philosophers as proof that his own happiness will not be promoted by seeking it in his own way. The temperament most likely to act consciously on such a rule of life is not the most generous; it is rather that which is cold and calculating, and which values the reputation more than the reality of virtue. Upon such men, at the best, its influence is to establish a low standard of virtue; perhaps only to check and impose limits on their tendencies to vice. Over others it can have little or no power, except when operating in combination with, and subordination to, higher principles.

Not only did the ethical systems of the ancients which were based upon this principle fail to make men moral, but we see its impotence constantly exemplified among those whom we call "men of the world"—a class of persons who are by no means indifferent to their own happiness, or to the good opinion of the world, but by whom the influence of religious belief is not practically felt; exemplified, too, on points of morality of which the reasonableness seems most manifest. There are no virtues, I suppose, which can more readily be shown to be conducive to happiness, whether particular or general, than that which the Greeks called *ἐγκράτεια*, and that of benevolence. What can be more contrary, to both at once of these, than the irregular indulgence of sensual appetite at the cost of the permanent degradation, and almost certain misery, of human beings who are its instruments and victims, and of innumerable physical as well as moral evils to individuals, families, and mankind at large? Yet how very common is this sort of immorality, even among cultivated men, living on good terms with society! How little is it reproved, how seldom restrained, except by the authority, or through the influence, direct or indirect, of religion! All readers of Horace remember the *sententia dia Catonis*, and I doubt whether non-religious opinion among ourselves is much stricter on this subject, though it may be less freely expressed. If it is otherwise as to some of the more abnormal forms of *ἀκρασία*, I have already said that this is specifically due to Christianity. The cultivated Greeks and Romans spoke and wrote lightly and familiarly of vices of which we do not speak at all: they regarded them, indeed, as effeminate, but not as infamous, and certainly did not visit them with grave social penalties. So tainted was their moral atmosphere, that even such really religious men among them as Socrates and Plato (to whom, however, a religion teaching morals with definiteness and authority was unknown) surprise us by their want of sensitiveness on these points, as manifested in some passages of the Socratic Dialogues.

I will next inquire whether a sufficient rule of morality is to be found, when religion is set aside, in any law of our nature: first, regarding the constitution of our nature apart from, and, secondly, taking into account, the existence in it of a moral instinct or sense.

If any one calls the application of right reason to human conduct generally a law of our nature, from which such a rule is to be derived, without taking into account the moral sense—this, as it seems to me, would be only a different and more indefinite mode of expressing substantially the

same theories, which have been already dealt with.

But it may, perhaps, be suggested that laws of our nature, from which such a rule may be derived, are to be found in the final causes and purposes of the several organs and powers which exist in that nature; and that the use of any of those organs or powers in a manner aberrant from their proper causes and purposes is a breach of natural morality. I do not pause to inquire whether the idea of "cause" and "purpose," which is involved in such a view, can be verified apart from religion. But such a rule would, at best, be far from coextensive with the whole field of morality; some most necessary parts of a moral code (such, e. g., as the regulation of the relations between the sexes) being incapable of being deduced, with any approach to certainty, from the mere constitution of our nature. As to some of our faculties, the determination, with sufficient accuracy, to furnish a rule of life, of their final causes and purposes, might involve difficult philosophical inquiries. As to others, though there might be no such difficulty, it is to be remembered that we have a complex nature, in which the forces which operate, either mechanically or in a way resembling the mechanical, upon the will, are constantly in practical antagonism to the regulative faculty. The faculties of which the final causes are most obvious exist, not apart from, but in combination with, other elements of our nature which (either generally or often) result in tendencies to their use without any direct view to the fulfillment of their proper purposes. The gratification of some of those tendencies (such, e. g., as eating and drinking for the mere pleasure of taste, and not for nourishment) can hardly be condemned as immoral, on natural grounds, unless carried so far as to overpower reason, or impair strength or health. When it is carried to that excess (as in the case of intemperance), it is still true that the origin of the vice has been in the natural constitution of men's bodies, by which a sensible gratification has been found in its indulgence: which (as it seems to me) goes far to prove that this conception of a physical law cannot be relied upon, even in the cases to which it is most directly applicable, as a practical basis of morality—a view which is confirmed by the actual prevalence among men of that class of vices, even when, to all natural safeguards, is superadded the external influence of religion.

When we proceed to take into account the moral instinct or sense, we come upon the border-ground, if not into the proper territory, of Religion. To a man who believes in a moral government of the universe, in the distinctness of the *Ego*, the real man, from his bodily organization, and in the doctrines of moral responsibility and moral adjustment in a future state, nothing can be more real, nothing more intelligible, than this moral instinct or sense, with its suggestions of right and wrong, of duty, guilt and sin, and its judicial conscience. But, if all these postulates are denied, what is then to be thought of this moral instinct or sense? Why is it, on that hypothesis, less a mere accident of the nervous system, or of some other part of the bodily organization, than the religious instinct, which is already supposed to be set aside, as resting upon no demonstrable ground? As a phenomenon, and in some sense a fact, it exists, just as the religious instinct does (if they be not really the same); but those principles of thought which explain away the one, as having no proper objective cause, and as indicative of no objective truth, may as easily explain away the other also. The one is not more susceptible of sensible and experimental demonstration than the other. If man were merely a higher order of the organization of matter, homogeneous with, and produced by spontaneous development from, inorganic substances, plants, and inferior animals, and under no responsibility to any moral intelligence greater than his own, what reality would there be in the conception of a moral law of obligation, inapplicable to all other known forms of matter, and applicable only to man?

These questions are practical. Experience, on the large scale, shows that men who disregard the religious, cannot generally be trusted to pay regard to the moral, sense. A moral sense, not believed in, can never supply a practical foundation for morality. On the other hand, a moral sense, believed in, is (in reality) itself religion—possibly inarticulate, but religion still. Such a belief cannot exist, without accepting the evidence of the moral sense as equally trustworthy concerning those things of which it informs us, as the evidence of the bodily senses is concerning those things of which they inform us. It is, of course, only from the impressions made upon our own minds that we can know anything about any of the subjects, either of physical, or of intellectual, or of moral sensation: their intrinsic nature, abstracted from those impressions, is to us, in each case alike, an inaccessible mystery. But belief in the sense is belief in the truth of the information which the sense gives to us; that is,

that this information, if rightly apprehended, is trustworthy, as far as it goes; that there are objective realities corresponding with it. The moral sense, believed in, is not merely a possible, but I suppose it to be the only possible, human foundation of morality. An intelligent belief in the moral sense naturally takes the man beyond himself, to a higher source of his moral conceptions, which it really presupposes; and any truths correlative to it, which are either ascertainable by the processes of reason, or capable of being otherwise made known, will naturally, when they become known, be recognized, in their proper relation to it, and cannot be rejected without doing it violence. Any such correlative knowledge of the higher truths (to the existence of which the moral sense testifies, though it does not fully reveal them) must enlighten, inform, and strengthen it. It is the office of such knowledge to answer authoritatively those questions, as to the real nature, the proper work, the true happiness, the true place in the universe, of man, which philosophy has always been asking, and has never, by itself, been able to solve. It harmonizes, accounts for, and enforces by authoritative sanctions, the concurrent testimonies of the moral sense, the religious instinct, Nature interpreted by reason, and reason enlightened by experience. On the other hand, the want, and still more the rejection, of such knowledge (supposing it to be attainable and true) must, in a corresponding degree, obscure, perplex, or discredit, the moral sense.

I am well aware that some who seem to reject all dogmatic theology, and even the principles of natural religion, do nevertheless live up to a high moral standard; just as there are too many others, professing (not always insincerely) to believe in religion, who do the reverse. The moral sense never has been, and never will be, extinguished among mankind; and in all ages and countries, of which we have any real historical knowledge, there have been conspicuous examples of men who have made it their rule of life. Doubtless there have been many more who did so, of whom we know nothing; nor is it unreasonable to believe that there may be many such even among very degraded races. But these facts do not invalidate general conclusions as to the general moral tendency of a decline of religious belief. Those examples of exceptional goodness have not been sufficient to prevent or to arrest a progressive deterioration of general morality when the light of religion has been absent or obscured; and the best ancient schemes of philosophy, which were founded upon the moral sense, failed to compete practically with that of materialism, which did all that was possible to destroy it. "Live while we may"—"let us eat and drink, for to-morrow we die"—are natural corollaries from the doctrine of Epicurus; whatever more refined conceptions that philosopher or any of his followers may have propounded. Such will ever be the effect, in the world generally, of a popular disbelief in the doctrines of immortality and retribution; not because the hope of rewards or the fear of punishments is the foundation of religious morality (which, to fulfill the requirements either of religion or of the moral sense, must ascend much higher), but because our nature is so constituted that the destiny of the individual, for good or evil, for happiness or the reverse, is inseparably bound up with the moral law of his being; and because those aids and defenses which result from the recognition of this truth are necessary for the ascendency of the higher over the lower elements of our nature, and for the education of man to virtue. A boy, whose mainsprings of right action are conscience and love, will not endeavor to fulfill the objects for which he is sent to school more selfishly, or from less worthy motives, when he is informed of their relation to his future life, than if he were left in ignorance of it; but the knowledge of that relation, by making him understand the importance of the future as compared with the present, and the meaning and reasonableness of his present duties, may enable him better to fulfill them.

All that has been said assumes, of course, that there is such a thing as religious truth: nor is it possible to deny that, if this could really be disproved, the morality founded upon it would fail. But it cannot be without importance, whenever the proper evidences of the truth of religion are considered, to take into account, as one of them, its relation to morality: the certainty that, if it were displaced, the system of morality now received among men would, to a great extent, fall with it; and the extreme intellectual difficulty of maintaining, in that event, the supremacy of the moral sense, or placing the morality of the future upon a new basis, likely to acquire general authority among mankind. If it should be suggested that a sufficient moral code, for practical purposes, might be maintained by increasing the stringency of human laws in proportion to the failure of religious sanctions, I should reply that the power of human laws depends upon morality, and not morality upon human laws; and that any legislation, greatly in advance of the moral senti-

ment of the community, would certainly not be effectual, and could not long be maintained.

It has been no part of my purpose to enter into an examination of any questions as to particular doctrines of religion. I have throughout used the word "religion" in a sense exclusive of all systems, usurping that name, which take no cognizance of morality, or which are repugnant, in their practical precepts, to the general moral sense of mankind; and I have not dissembled my belief that Christianity (regarded in its general aspect, with reference to the points of agreement rather than those of difference among Christians) does fulfill the conditions necessary for moral efficacy. Error, inconsistency, incompleteness, or admixture of foreign elements, in particular modes of apprehending or representing it, must, no doubt, as far as they prevail, and in proportion to their importance, detract from the authority, or deteriorate the quality, of its influence. So also must the mere fact of disagreement. But, notwithstanding all these drawbacks, Christianity is the great moral power of the world. It has often been supposed to be declining, but has, as often, renewed its strength; nor has any other power been found to take its place, where it has seemed to lose ground. As to other forms of religion it may, without difficulty, be admitted that such elements as they have in common with Christianity may be expected (except so far as they are neutralized or counteracted by other contrary elements) to tend, in their measure, toward the same standard of morality. It is proper (as I suppose) to Christianity, rightly understood, to assert the identity of its own essential principles with those of natural religion, while teaching that the moral government of the world has been so conducted as not to leave mankind dependent upon natural religion only; and it refers to a common origin with itself all the elements of religious belief, consistent with its own doctrines, which have been, at any time or place, accepted among the nations of the world. These propositions, and also that of the presence of the religious principle in any practical belief of the moral sense, appear to be in accordance with what is said by St. Paul in the nineteenth and twentieth verses of the first, and the fourteenth and fifteenth verses of the second, chapters of the Epistle to the Romans.

Rev. Dr. MARTINEAU.—In order to estimate aright the moral influence of declining religious belief, the relation between morals and religion must be accurately conceived. They may be regarded as independent, or as identical, or, again, either may be taken to be the foundation of the other. The following positions will serve as a sufficient ground for the opinion which I shall offer:

A sense of duty is inherent in the constitution of our nature, and cannot be escaped till we can escape from ourselves. It does not wait on any ontological conditions, and incur the risk of non-existence should no assurance be gained with regard to a being and a life beyond us. Even though we came out of nothing, and returned to nothing, we should be subject to the claim of righteousness so long as we are what we are. Morals have their own base, and are second to nothing.

Apart from this intrinsic consciousness of ethical distinctions, no ontological discoveries would avail to set up a law of duty, and give us the characteristics of moral beings. A Supreme Power might dictate an external rule, and break us in to obedience by hopes and fears of unlimited extent. But by this sway of preponderant interests we are not carried beyond prudence; and in the absence of a law within, responding to the demands from without, we do not reach the confines of moral obligation; and, in case of failure, we incur the sense only of error, not of sin. Theology cannot supply a base for morals that have lost their own.

Does it follow that, because morals are indigenous, they are therefore self-sufficing? By no means. Though religion is not their foundation, it is assuredly their crown—related to them as Plato says dialectic is to the sciences, ὥσπερ θριγκὸς τοῖς μαθήμασιν[1]—the *coping* that consummates them. Be the genesis of the conscience what it may, we learn from it at last that there is a better and a worse in the springs of action which contend for us, and that, while it is open to us as a possibility, it is closed against us as a right, to follow the lower when the higher calls. The *authority* which stamps the one as a temptation, and the other as a peremptory claim, is not, we are well aware, of our own making; for it masters us with compunction, and defies all repeal. Nor is it the mere expression of public self-interest; for it extends beyond the range of social action, and covers the whole voluntary field. Speaking with a voice before which our whole personality bows, and which equally gives law to other men, it issues from a source transcending human life, and infusing into it a moral order from a more comprehensive sphere. It postulates a superior will in communion with

[1] *Rep.*, vii., 534 E.

ours, and administering this world as a school of character.

To this result our moral experience naturally runs up, and stops short of it only where its course is artificially arrested. Till it is reached, the ethical demands upon us seem to address us in tones too portentous for their immediate significance; remorse clings to us with a tenacity, aspiration returns upon us with a power, which reason cannot adequately justify. But in the presence of an objective moral law pervading the universe, administered by a Mind wherein it perfectly lives, and continued for man beyond his present term of years, the scale of the ethical passions, and the intensity of admiration and reverence for the good, fall into proportionate place, and escape the irony of being at once the ultimate nobleness and the supreme extravagance of our nature. Religion, on this side, is but the open blossom of the moral germs implanted within us—the explicit form, developed in thought, of faiths implicitly contained in the sense of responsibility and the forebodings of guilt. Its effect, therefore, is to suffuse with a divine light relations and duties which before were simply personal and social.

A similar transfiguration befalls the pleasures and pains attending voluntary conduct, and constituting its natural "sanctions." Treated as ultimate facts, they can never acquire more than a prudential significance. Treated as symbolical lineaments of a world under moral government, they are invested with an expression of character, and look into us with living eyes. Their appeal alights no longer on self-regarding hope and fear, but on the springs of sympathy and shame: they pass from sensitive to ethical phenomena. The new and ideal meaning thus given to a large portion of actual human experience cannot pause there; it completes itself in the congenial anticipation of a further and invisible store of awards consummating the incipient justice of this world. The faith in a future life—where it is more than a belief at second hand—has its sheet-anchor in the moral affections. But for the felt interval between what we are and what we ought to be, for the indignation at wrong, for compassion toward innocent suffering, and reverence for high excellence, vaticinations of renewed existence would have no origin and no support.

In assigning this method of growth to religion, I do not mean to deny that it may have other lines of formation. The Nature-worship which plays so great a part in ancient civilization has a different history, and stands in much less intimate relations with the moral life of its votaries. We pay, I am disposed to think, too great a compliment to the Greek mythology when we attribute the ethical decay of later Athens and Corinth to the growing skepticism about its gods. The public life was dead. The theatre of great passion and great action was closed. The calls for sacrifice, the opportunities for national expansion, were gone, and the political school for the discipline of character was no longer there. With the loss of a progressive history, the springs of heroic emulation suffered atrophy, a sickly hue passed over literature, philosophy, and art; and the subsidence of human loves and cares upon low Epicurean levels was inevitable, though the Olympian deities had never been dethroned. In the *absence* of any moral religion, no efficacious resistance could be set up, with or without a pantheistic polytheism, against the canker of social degeneracy.

In dealing with the present problem, however, we confine our attention to the Christian type of religion, which has its hold upon our nature from the moral side. The question is, what practical effect might be expected from a decay of that religion.

Under that change morality would lose, not its base, but its summit. The ground and principles of duty would remain; the means for deducing rules of action, estimating the worth of conflicting impulses, and measuring the grades of obligation, would in the main be unaffected; so that the moral code which would emerge from the labors of a mere philosopher need not materially differ from that recognized by a Christian. This is only an inverse method of saying that the Christian ethics are true to human life and the expression of right reason. I do not think, therefore, that the form and contents of a moral system would be essentially modified by the decline of religious belief. It may, no doubt, happen that particular problems of conduct, as in the cases of suicide and of marriage, have become the subjects of ecclesiastical legislation, and so have passed into preoccupation of religious feeling, and, on the disappearance of that feeling, may be flung back into an indeterminate condition. But to the real solution of such problems it would be difficult to show that religion contributes any new elements, so as to turn into duty that which was not duty before. Its ministers and temporary interpreters can give an historical consecration to all sorts of ungrounded opinions, and these will in any case have to look out for an adequate base, whether or not the re-

ligious view of life is still upheld. But it is quite possible that a rule of life, once thoughtfully constituted, should be acknowledged in common over the whole range of social duty by persons simply ethical and by those who are also religious.

But though the decay of religion may leave the institutes of morality intact, it drains off their inward power. The devout faith of men expresses and measures the intensity of their moral nature, and it cannot be lost without a remission of enthusiasm and, under this low pressure, the successful reëntrance of importunate desires and clamorous passions which had been driven back. To believe in an ever-living and perfect Mind, supreme over the universe, is to invest moral distinctions with immensity and eternity, and lift them from the provincial stage of human society to the imperishable theatre of all being. When planted thus in the very substance of things, they justify and support the ideal estimates of the conscience; they deepen every guilty shame; they guarantee every righteous hope; and they help the will with a divine casting-vote in every balance of temptation. The sanctity thus given to the claims of duty, and the interest that gathers around the play of character, appear to me more important elements in the power of religion than its direct sanctions of hope and fear Yet to these also it is hardly possible to deny great weight, not only as extending the range of personal interests, but as the answer of reality to the retributory verdicts of the moral sense. Cancel these beliefs, and morality will be left reasonable still, but paralyzed; possible to temperaments comparatively passionless, but with no grasp on vehement and poetic natures; and gravitating toward the simply prudential wherever it maintains its ground.

Historical experience appears to confirm this estimate. In no race (notwithstanding conspicuous individual exceptions) have the excesses of sensual passion been so kept in check as among the Jews. There is no more striking feature in their literature during the moral declension of Greek and Roman society (e. g., in the Sibylline Oracles) than the horror which it expresses of the pervading dissoluteness of the pagan world. It certainly cannot be said that the problem was rendered easy by the coolness of the Jewish temperament. The phenomena of Christendom present a more complicated tissue. But a just analysis yields, I believe, the same result, and attests the force of religious conviction as the only successful antagonist, on any large scale, of the animal impulses. True it is that, in the very presence of the Church, and even among its representatives, gross vices have at times prevailed. But these have been hollow times, in which, with large classes of persons, the outer shell of religion sheltered no sincere life, and the private habits betrayed the inward disintegration which policy or indifference concealed. To test the power of religion, we must limit ourselves to cases where that power is not effete. In the Puritan families of the seventeenth century, among the present Catholic peasantry of Ireland, throughout the Society of Friends, and in the Wesleyan classes, it can hardly be denied that the control of irregular desires has been attained with an exceptional ease and completeness.

One source of this distinctive power yet remains to be indicated. A simply conscientious man may surrender himself unreservedly to the sense of moral obligation, and be so possessed by it as to feel it more than reasonable, and own a certain sacredness in its appeal. Duty, honor, self-forgetfulness in others' good, may obtain the real command of such a one. But the persuasive force with which the right speaks to him is beyond all intellectual measure; it stirs him in depths he cannot reach; its heat is in excess of its light; it is something mystic which must have him, but of which he can render no account. Here, in truth, is religion pressing into life, only with form still indistinct, and its organism of thought not yet differentiated and articulate. Let it complete its development, and what change will ensue? Once rendered conscious of the Supreme Source of his moral perceptions, the responsible agent no longer obeys a pressure out of the dark, but rather a drawing toward higher light; for an impersonal drift of Nature is substituted a profound personal veneration, and enthusiasm is turned from a blind nobleness into the clear allegiance of living affection. It is not without reason that this change has been treated as an emergence into new life. Its vast influence is attested by the whole literature of devotion, and especially by its most popular element, the hymns of every age from the Psalter to the "Christian Year."

Though in theory the contents of morality are not altered by acquiring divine obligation, the efficacy of religion is more immediately felt in some parts of the character than in others. The scene to which it introduces the mind is one which throws it instantly into the attitude of looking up toward an Infinite Perfection, whose

presence it never quits, and thus supplies the true conditions of humility, of aspiration, and of felt equality of moral trust for all men before God. These moods of thought are specifically induced by the contact of higher excellence and a more capacious rule of righteousness; and they are but poorly simulated by the mere sense of personal insignificance amid the immensity of Nature, and the awe of the unknown, and the conscious partnership of us all in the human liabilities. The moral characteristics of the Christian temper are nothing but the natural posture of a mind standing face to face with the invisible reality of the highest ideals of its conscience and its love. If that presence departs, they cannot survive.

MR. FREDERIC HARRISON.—And all this, to me, describes the moral characteristics, not of the Christian, but of the religious temper. With what has been so finely said in the preceding discourse we ought, I think, most cordially to join. Only for the words "theology" and "Christian" we must put the wider and more ancient terms "religion" and "human;" and again, for the intrinsic consciousness and emotional intuitions, whereby these are said to prove themselves, we must substitute the reasonable proof of science, philosophy, and positive psychology.

We have had before us three distinctive views as to the relations of religion and morality. Each of the three has pressed on us a very powerful thought. The reconciliation is obscure, yet I hold on to the hope that it may one day be found; that we shall have to surrender neither religion nor science, neither demonstration on the one hand, nor dogma, worship, and discipline, on the other; that we shall end by accepting a purely human base for our morality, and withal come to see our morality transfigured into a true religion.

It is the purport of the first of the arguments before us to establish: that morality has a basis of its own quite independent of all theology whatever; but that, since morality must be deeply affected by any theology, the morality will be undermined if based on a theology which is not true. We must all agree, I think, to that.

The second argument insists that, if the religious foundations and sanctions of morality be given up, human life runs the risk of sinking into depravity, since morality without religion is insufficient for general civilization. For my part, I entirely assent to that.

The third argument rejoins, that theology cannot supply a base for morals that have lost their own; but that morals, though they have their own base, and are second to nothing, are not adequate to direct human life until they be transfused into that sense of resignation, adoration, and communion with an overruling Providence, which is the true mark of religion. I assent entirely to that.

We, who follow the teaching of Comte, humbly look forward to an ultimate solution of all such difficulties by the force of one common principle. That we acknowledge a religion, of which the creed shall be science; of which the faith, hope, charity, shall be real, not transcendental—earthly, not heavenly; a religion, in a word, which is entirely human in its evidences, in its purposes, in its sanctions and appeals. Write the word "religion" where we find the word "theology;" write the word "human" where we find the word "Christian," or the words "theist," "Mussulman," or "Buddhist," and these discussions grow practical and easily reconciled; the aspirations and sanctions of religion burst open to us anew in greater intensity, without calling on us to surrender one claim of reality and humanity; the realm of faith and adoration becomes again conterminous with life, without disturbing—nay, while sanctifying—the invincible resolve of modern men to live *in* this world, *for* this world, *with* their fellow-men.

And this brings us to the source of all difficulties about the relations of morality and religion. We place our morality—we are compelled by the conditions of all our positive knowledge to place it—in a strictly human world. But it is the mark of every theology (the name of theology assumes it) to place our religion in a non-human world. And thus our human system of morals may possibly be distorted—it cannot be supported—by a non-human religion. But, on the other hand, it is dwarfed and atrophied for want of being duly expanded into a truly human religion. Our morality, with its human realities, our theology, with its non-human hypotheses, will not amalgamate. Their methods are in conflict. In their base, in their logic, in their aim, they are heterogeneous. They do not lie *in pari materiâ*. Give us a religion as truly human, as really scientific, as is our moral system, and all is harmony. Our morals, based as they must be on our knowledge of life and of society, are then ordered and inspired by a religion which belongs, just as truly as our moral science does, to the world of science and of man. And then religion will be no longer that quicksand of possibility which

two thousand years of debate have still left it to so many of us. It becomes, at last, the issue of our knowledge, the meaning of our science, the soul of our morality, the ideal of our imagination, the fulfillment of our aspirations, the lawgiver, in short, of our whole lives. Can it ever be this while we still pursue religion into the bubble-world of the whence and the whither?

That morality is dependent on theology; that morality is independent of religion: each of these views presents insuperable difficulties, and brings us to an alternative from which we recoil. To assert that there is no morality but what is based on theology, is to assert what experience, history, and philosophy, flatly contradict—nay, that which revolts the conscience of all manly purpose within us. History teaches us that some of the best types of morality, in men and in races, have been found apart from any thing that Christians can call theology at all. Morality has been advancing for centuries in modern Europe, while theology, at least in authority, has been visibly declining. The morality of Confucius and of Sakya Mouni, of Socrates and Marcus Aurelius, of Vauvenargues, Turgot, Condorcet, Hume, was entirely independent of any theology. The moral system of Aristotle was framed without any view to theology, as completely as that of Comte or of our recent moralists. We have experience of men with the loftiest ideal of life and of strict fidelity to their ideal, who expressly repudiate theology, and of many more whom theology never touched. Lastly, there is a spirit within us which will not believe that to know and to do the right we must wait until the mysteries of existence and the universe are resolved—its origin, its government, and its future. To make right conduct a corollary of a theological creed, is not only contrary to fact, but shocking to our self-respect. We know that the just spirit can find the right path, even while the judgment hangs bewildered amid the churches.

To hold, as would seem to require of us the second argument, that, though theology is necessary as a base for morality, yet almost any theology will suffice—polytheist, Mussulman, or deist—so long as some imaginary being is postulated, this is, indeed, to reduce theology to a minimum; since, in this case, it does not seem to matter in which God you may believe. To say that morality is dependent on *one* particular theology, is to deny that men are moral outside your peculiar orthodoxy; to say that morality is dependent merely on *some* form of theology, is to say that it matters little to practical virtue which of a hundred creeds you may profess. And when we shrink from the arrogance of the first and the looseness of the second position, we have no alternative but to admit that our morality must have a human, and not a superhuman, base.

It does not follow that morality can suffice for life without religion. Morality, if we mean by that the science of duty, after all can supply us only with a knowledge of what we should do. Of itself it can neither touch the imagination, nor satisfy the thirst of knowledge, nor order the emotions. It tells us of human duty, but nothing of the world without us; it prescribes to us our duties, but it does not kindle the feelings which are the impulse to duty. Morality has nothing to tell us of a paramount power outside of us, to struggle with which is confusion and annihilation, to work with which is happiness and strength; it has nothing to teach us of a communion with a great Goodness, nor does it touch the chords of veneration, sympathy, and love, within us. Morality does not profess to organize our knowledge and give symmetry to life. It does not deal with beauty, affection, adoration. If it order conduct, it does not correlate this conduct with the sum of our knowledge, or with the ideals of our imagination, or with the deepest of our emotions. To do all this is the part of religion, not of morality; and inasmuch as the sphere of this function is both wider and higher, so does religion transcend morality. Morality has to do with conduct, religion with life. The first is the code of a part of human nature, the second gives its harmony to the whole of human nature. And morality can no more suffice for life, than a just character would suffice for any one of us without intellect, imagination, or affection, and the power of fusing all these into the unity of a man.

The lesson, I think, is twofold. On the one hand, morality is independent of theology, is superior to it, is growing while theology is declining, is steadfast while theology is shifting, unites men while theology separates them, and does its work when theology disappears. There is something like a civilized morality, a standard of morality, a convergence about morality. There is no civilized theology, no standard of theology, no convergence about it. On the other hand, morality will never suffice for life; and every attempt to base our existence on morality alone, or to crown our existence with morality alone, must certainly fail: for this is to fling away the most powerful motives of human nature. To reach these is the privilege of religion alone. And those who trust that the future can ever be

built upon science and civilization, without religion, are attempting to build a pyramid of bricks without straw. The solution, we believe, is a non-theological religion.

There are some who amuse themselves by repeating that this is a contradiction in terms, that religion implies theology. Yet no one refuses the name of religion to the systems of Confucius and Buddha, though neither has a trace of theology. But disputes about a name are idle. If they could debar us from the name of religion, no one could disinherit us of the thing. We mean by religion a scheme which shall explain to us the relations of the faculties of the human soul within, of man to his fellow-men beside him, to the world and its order around him; next, that which brings him face to face with a Power to which he must bow, with a Providence which he must love and serve, with a Being which he must adore—that which, in fine, gives man a doctrine to believe, a discipline to live by, and an object to worship. This is the ancient meaning of religion, and the fact of religion all over the world in every age. What is new in our scheme is merely that we avoid such terms as infinite, absolute, immaterial, and vague negatives altogether, resolutely confining ourselves to the sphere of what can be shown by experience, of what is relative and not absolute, and wholly and frankly *human*.

THE DEAN OF ST. PAUL'S. — It seems to me difficult to discuss this question till it is settled, at least generally, what morality is influenced, and what religious belief is declining.

The morality generally acknowledged in Europe differs in most important points from that of the Hebrews in the days of Moses, of the Greeks in the days of Socrates, of the Romans under the empire, of the monks of Egypt, of the Puritans of the seventeenth century. All of these had among them high types of character, higher, it may be, than any types among us; but who among us would accept their morality as a whole? Our morality has come to be recognized as it is by a definite progress of which the steps may be traced. It is plain that one form of religious thought and religious faith might aid this progress of morality by its decline, and another might, by its decline, impede or reverse it. On such a morality as we acknowledge, whencesoever derived, the decline of Buddhist belief or ancient Roman religious belief might act as a stimulus and a help. The decline of another kind of religious belief might, on the other hand, act most injuriously.

It seems to me, therefore, that till the question is presented in a concrete and historical form, nothing can be made of it. I do not understand the two terms of the comparison. Before I can attempt to answer it, I must know, at least approximately, *what* morality and *what* religion.

If by morality is meant the morality generally recognized in Europe on the points of truthfulness, honesty, humanity, purity, self-devotion, kindness, justice, fellow-feeling—and not only recognized, but judged by a conscious superiority of reason and experience to be the right standard, as compared with other moralities, such as those of the Puritans, the monks, the Romans, the Hebrews—then I observe that, as a matter of fact and history, which to me seems incontrovertible, this morality has synchronized in its growth and progress with an historical religion, viz., Christianity. We are come to the end of eighteen of the most eventful and fruitful centuries of all, at least, that are known to us; and we are landed in what we accept as a purer morality than any which has been known in the world before, and one which admits itself not to be perfect, but contains in itself principles of improvement and self-purification. With this progress from the first—sometimes, I quite admit, with gross and mischievous mistakes, but always with deliberate aim and intention of good—Christianity has been associated. And in proportion as Christian religious belief has thrown off additions not properly belonging to it, and has aimed at its own purification and at a greater grasp of truth, the standard and ideas of morality have risen with it. The difficulty at this moment is to determine how much of our recognized morality, both directly and much more indirectly, has come from Christianity, and could not conceivably have come at all, supposing Christianity absent.

I do not here, in these few lines, assume that in Christianity and its long association with human morality we have a *vera causa* of its improved and improving character. But with this immense fact of human experience before me, unique, it seems to me, in its kind, and in its broad outlines undeniable, no abstract reasonings can reassure me as to the probability that with the failing powers of what has hitherto been, directly or indirectly, the source of much, and the support and sanction of still more, of our morality, our morality will fail too. It seems to me quite as easy to be skeptical about morality as it is about religion. If the religion has been proved to be not true, then, of course, it is no use talking about the

matter. But if not, a declining belief in it may, with our present experience, be thought, at least by those who believe in it, to be attacking the roots of morality, if not in our own generation, at least in those which come after.

It is matter of history that in what we now generally accept as true morality there are two factors: 1. On the one hand, human experience, human reasonableness, human good-feeling, human self-restraint; and, 2. On the other, the belief, the laws, the ideas, the power, of Christianity. It is difficult to conceive what reason there is to expect that if one factor is taken away the result will continue the same; that the removal or weakening of such an important one as Christianity would not seriously affect such departments of morals as purity, the relations of the strong to the weak, respect for human life, slavery.

THE DUKE OF ARGYLL.—Considering that these papers are contributed by men belonging to very different schools of thought, and that they deal with a question very abstract and very ill-defined, it is surely very remarkable that so much agreement should emerge on certain fundamental points.

Most remarkable of all, in this respect, is the paper emanating from one of those who "follow the teaching of Comte."

In that paper I find the following propositions:

I. That morality is independent of theology; but—

II. That it is not independent of religion, inasmuch as morality without religion cannot "suffice for life."

III. That religion means a scheme which (among other things) "brings man face to face with a Power to which he must bow, with a Providence which he must love and serve, with a Being which he must adore—that which, in fine, gives man a doctrine to believe, a discipline to live by, and an object to worship."

IV. That this scheme or conception of religion is "new," and differs from mere theology in the following distinctive points:

1. That it avoids certain words or phrases, such as "infinite," "absolute," "immaterial."

2. That it avoids also all "vague negatives."

3. That it resolutely confines us to the sphere of what can be shown by experience—"of what is relative and not absolute," and "of what is wholly and frankly human."

I will examine these propositions in their order.

Proposition I. clearly depends entirely on what is meant by theology, and on the distinction which is drawn in the propositions which follow between theology and religion. Two things, however, may be said of this proposition: First, that, as a matter of historical fact, men's conceptions of moral obligation have been deeply influenced by their conceptions and beliefs about theology, or about the "whence and whither." Secondly, that, as all branches of truth are and must be closely related to each other, it cannot possibly be true that morality is independent of theology, except upon the assumption that there is no truth in any theology. But this is an assumption which cannot be taken for granted, being very different indeed from the assumption (which may be reasonable) that no existing theology is unmixed with error. The absolute independence of morality as regards theology, assumes much more than this; it assumes that there is no theology containing even any important element of truth.

Proposition II. is, I think, perfectly true.

Proposition III. contains a definition of religion which might probably be accepted by any theological professor in any of our schools of divinity as good and true, if not in all respects adequate or complete.

Proposition IV. defines the elements in all theologies which constitute their fundamental errors, and which distinguish them from religion as defined in Proposition III. In short, Proposition III. defines affirmatively what religion is; and Proposition IV. defines negatively what it is not. It adds also a few more affirmative touches to complete the picture of what it is.

Looking now at the erroneous theological elements which are to be thrown away, we find three words fixed upon as specimens of what is vicious. One of them is "the Absolute." Most heartily do I wish it were abolished. More nonsense has been talked and written under cover of it than under cover of any other of the voluminous vocabulary of unintelligible metaphysics. It is admitted that the Absolute is "unthinkable," and things which are unthinkable had better be considered as also unspeakable, or at least be left unspoken.

Next, "immaterial" is another word to be cast away. The worst of this demand is, that the words material and immaterial express a distinction of which we cannot get rid in thought. I do know that the pen with which I now write is made of that which to me is known as matter; but I do not know that the ideas which are expressed in this writing are made of any like substance, nor even of any substance like the brain.

On the contrary, it seems to me that these ideas cannot be so made, and that there is an absolute difference between thought and the external substances which it thinks about. This may be my ignorance, but until that ignorance is removed I must accept those distinctions which are founded on the experience and observation of my own nature, and I must retain words which are necessary to express them.

Then, as regards the word "infinite," in like manner, I cannot dispense with it, for the simple reason that the idea of infinity is one of which I cannot get rid, and which all science teaches me is an idea inseparable from our highest conceptions of the realities of Nature. Infinite time and infinite space, and the infinite duration of matter and of force, are conceptions which are part of my intellectual being, and I cannot "think them away." Metaphysicians may tell me that they are "forms of thought." But if so, they are at least all the more "frankly human," and I accept them as such.

Next we are to avoid "vague negatives altogether." Well, but surely a definition of religion as distinguished from theology, which consists in "avoiding" certain terms such as we have now examined, is a definition consisting of "vague negatives," and of nothing else.

But then we come next to an affirmative definition: "confining ourselves resolutely to the sphere of what can be shown by experience." To this I assent, provided experience be not confined to the sphere of sense, and provided everything which any man has ever felt, or known, or conceived, be accepted as in its own place and rank coming within the sphere which is thus described.

Again, it is demanded of us that we confine ourselves resolutely within "what is relative and not absolute." To this I assent. All knowledge is relative—relative both to the mind which knows, and relative also to all other things which remain to be known. Absolute goodness, and absolute power, and absolute knowledge, are all conceivable, but they are all relative; and to talk of any object of knowledge, or of any subject of knowledge, as non-relative, is, or seems to me to be, simply nonsense.

Lastly, it is demanded of us to confine ourselves to what is "wholly and frankly human." If this means that we are not to think of any power or any being who is not related to our human faculties in a most definite and intelligible sense, I accept the limitation. But if it means that we are not to think of any such power or being except under all the imperfections, weaknesses, and vices of humanity, then the limitation is one which I cannot accept either as conceivable in itself, or as consistent with what I can see or understand of Nature.

But ought we not to be agreed in this? If there is a Power to which man "must bow," "a Being which he must adore," and a "Providence which he must love and serve," it is clearly impossible that this Being, Power, or Providence can be "wholly human," in the sense of being no greater, no wiser, no better, than man himself.

The whole of this language is the language of theology and of nothing else—language, indeed, which may be held consistently with a vast variety of theological creeds, but which is inseparable from those fundamental conceptions which all such creeds involve, which is borrowed from them, and without which it has to me no intelligible sense.

With these explanations I accept the tenth paragraph of Paper No. IV., and that part of the last paragraph which has been already quoted, as expressing with admirable force and truth at least one aspect of the connection between morals and religion.

PROF. CLIFFORD.—In the third of the preceding discourses there is so much which I can fully and fervently accept, that I should find it far more grateful to rest in that feeling of admiration and sympathy, than to attend to points of difference which seem to me to be of altogether secondary import. But for the truth's sake this must first be done, because it will then be more easy to point out some of the bearings of the position held in that discourse upon the question which is under discussion.

That the sense of duty in a man is the prompting of a self other than his own, is the very essence of it. Not only would morals not be self-sufficing if there were no such prompting of a wider self, but they could not exist; one might as well suppose a fire without heat. Not only is a sense of duty inherent in the constitution of our nature, but the prompting of a wider self than that of the individual is inherent in a sense of duty. It is no more possible to have the right without unselfishness, than to have man without a feeling for the right.

We may explain or account for these facts in various ways, but we shall not thereby alter the facts. No theories about heat and light will ever make a cold fire. And no doubt or disproof of any existing theory can any more extinguish that

self other than myself, which speaks to me in the voice of conscience, than doubt or disproof of the wave-theory of light can put out the noonday sun.

One such theory is defended in the discourse here dealt with, and, if I may venture to say so, is not quite sufficiently distinguished from the facts which it is meant to explain. The theory is this: that the voice of conscience in my mind is the voice of a conscious being external to me and to all men, who has made us and all the world. When this theory is admitted, the observed discrepancy between our moral sense and the government of the world, as a whole, makes it necessary to suppose another world and another life in it for men, whereby this discord shall be resolved in a final harmony.

I fully admit that the theistic hypothesis, so grounded, and considered apart from objections otherwise arising, is a reasonable hypothesis and an explanation of the facts. The idea of an external conscious being is unavoidably suggested, as it seems to me, by the categorical imperative of the moral sense; and, moreover, in a way quite independent, by the aspect of Nature, which seems to answer to our questionings with an intelligence akin to our own. It is more reasonable to assume one consciousness than two, if by that one assumption we can explain two distinct facts; just as if we had been led to assume an ether to explain light and an ether to explain electricity, we might have run before experiment and guessed that these two ethers were but one. But since there is a discordance between Nature and conscience, the theory of their common origin in a mind external to humanity has not met with such acceptance as that of the divine origin of each. A large number of theists have rejected it, and taken refuge in Manichæism and the doctrine of the Demiurgus in various forms; while others have endeavored, as aforesaid, to redress the balance of the old world by calling into existence a new one.

It is, however, a very striking and significant fact, that the very great majority of mankind who have thought about these questions at all, while acknowledging the existence of divine beings and their influence in the government of the world, have sought for the spring and sanction of duty in something above and beyond the gods. The religions of Brahmanism and of Buddhism, and the moral system of Confucius, have together ruled over more than two-thirds of the human race during the historic period; and in all of these the moral sense is regarded as arising indeed out of a universal principle, but not as personified in any conscious being. This vast body of dissent might well, it should seem, make us ask if there is anything unsatisfying in the theory which represents the voice of conscience as the voice of a god.

Although, as I have said, the idea of an external conscious being is unavoidably suggested by the moral sense, yet, if this idea should be found untrue, it does not follow that Nature has been fooling us. The idea is not in the facts, but in our inference from the facts. A mirror unavoidably suggests the idea of a room behind it; but it is not our eyes that deceive us, it is only the inference we draw from their testimony. Further consideration may lead to a different inference of far greater practical value.

Now, whether or no it be reasonable and satisfying to the conscience, it cannot be doubted that theistic belief is a comfort and a solace to those who hold it, and that the loss of it is a very painful loss. It cannot be doubted, at least by many of us in this generation, who either profess it now, or received it in our childhood and have parted from it since with such searching trouble as only cradle-faiths can cause. We have seen the spring sun shine out of an empty heaven, to light up a soulless earth; we have felt with utter loneliness that the Great Companion is dead. Our children, it may be hoped, will know that sorrow only by the reflex light of a wondering compassion. But to say that theistic belief is a comfort and a solace, and to say that it is the crown or coping of morality, these are different things.

For in what way shall belief in God strengthen my sense of duty? *He is a great one working for the right.* But I already know so many, and I know these so well. *His righteousness is unfathomable; it transcends all ideals.* But I have not yet fathomed the goodness of living men whom I know; still less of those who have lived, and whom I know. And the goodness of all these is a striving for something better; now it is not the goal, but the striving for it, that matters to me. The essence of their goodness is the losing of the individual self in another and a wider self; but God cannot do this; his goodness must be something different. *He is infinitely great and powerful, and he lives forever.* I do not understand this mensuration of goodness by foot-pounds, and seconds, and cubic miles. A little field-mouse, which busies itself in the hedge, and does not mind my company, is more to me than the longest ichthyosaurus that ever

lived, even if he lived a thousand years. When we look at a starry sky, the spectacle whose awfulness Kant compared with that of the moral sense, does it help out our poetic emotion to reflect that these specks are really very very big, and very very hot, and very very far away? Their heat and their bigness oppress us; we should like them to be taken still farther away, the great blazing lumps. But when we think of the unseen planets that surround them, of the wonders of life, of reason, of love, that may dwell therein, then indeed there is something sublime in the sight. Fitness and kinship: these are the truly great things for us, not force and massiveness and length of days.

Length of days, said the old rabbi, is measured not by their number, but by the work that is done in them. We are all to be swept away in the final ruin of the earth. The thought of that ending is a sad thought; there is no use in trying to deny this. But it has nothing to do with right and wrong; it belongs to another subject. Like All-father Odin, we must ride out gayly to do battle with the wolf of doom, even if there be no Balder to come back and continue our work. At any rate the right will have been done; and the past is safer than all storehouses.

The conclusion of the matter is, that belief in God and in a future life is a source of refined and elevated pleasure to those who can hold it. But the foregoing of a refined and elevated pleasure, because it appears that we have no right to indulge in it, is not in itself, and cannot produce as its consequence, a decline of morality.

There is another theory of the facts of the moral sense set forth in the succeeding discourse, and this seems to me to be the true one. The voice of conscience is the voice of our father man who is within us; the accumulated instinct of the race is poured into each one of us, and overflows us, as if the ocean were poured into a cup.[1] Our evidence for this explanation is that the cause assigned is a *vera causa* it undoubtedly exists; there is no *perhaps* about that. And those who have tried tell us that it is sufficient; the explanation, like the fact, "covers the whole voluntary field." The lightest and the gravest action may be consciously done in and for man. And the sympathetic aspect of Nature is explained to us in the same way. In so far as our conception of Nature is akin to our minds that conceive it, man made it; and man made us, with the necessity to conceive it in this way.[1]

I do not, however, suppose that morality would practically gain much from the wide acceptance of true views about its nature, except in a way which I shall presently suggest. I neither admit the moral influence of theism in the past, nor look forward to the moral influence of humanism in the future. Virtue is a habit, not a sentiment or an -ism. The doctrine of total depravity seems to have been succeeded by a doctrine of partial depravity, according to which there is hope for human affairs, but still men cannot go straight unless some tremendous, all-embracing theory has a finger in the pie. Theories are most important and excellent things when they help us to see the matter as it really is, and so to judge what is the right thing to do in regard to it. They are the guides of action, but not the springs of it. Now the spring of virtuous action is the social instinct, which is set to work by the practice of comradeship. The union of men in a common effort for a common object—*band-work*, if I may venture to translate coöperation into English—this is, and always has been, the true school of character. Except in times of severe struggle for national existence, the practice of virtue by masses of men has always been coincident with municipal freedom, and with the vigor of such unions as are not large enough to take from each man his conscious share in the work and in the direction of it.

What really affects morality is not religious belief, but a practice which, in some times and places, is thought to be religious—namely, the practice of submitting human life to clerical control. The apparently destructive tendency of modern times, which arouses fear and the foreboding of evil in the minds of many of the best of men, seems to me to be not mainly an intellectual movement. It has its intellectual side, but that side is the least important, and touches comparatively few souls. The true core of it is a firm resolve of men to know the right at first hand, which has grown out of the strong impulse given to the moral sense by political freedom. Such a resolve is a necessary condition to the existence of a pure and noble theism like that of the third discourse, which learns what God is like by thinking of man's love for man. Although that doctrine has been prefigured and led up to

[1] Schopenhauer. There is a most remarkable article on the "Natural History of Morals" in the *North British Review*, December, 1867.

[1] For an admirable exposition of the doctrine of the social origin of our conceptions, *see* Prof. Croom Robertson's paper, "How we come by our Knowledge," in the first number of this review.

for many ages by the best teaching of Englishmen, and—what is far more important—by the best practice of Englishmen, yet it cannot be accepted on a large scale without what will seem to many a decline of religious belief. For assuredly if men learn the nature of God from the moral sense of man, they cannot go on believing the doctrines of popular theology. Such change of belief is of small account in itself, for any consequences it can bring about; but it is of vast importance as a symptom of the increasing power and clearness of the sense of duty.

On the other hand, there is one "decline of religious belief," inseparable from a revolution in human conduct, which would indeed be a frightful disaster to mankind. A revival of any form of sacerdotal Christianity would be a matter of practice and not a matter of theory. The system which sapped the foundations of patriotism in the old world; which wellnigh eradicated the sense of intellectual honesty, and seriously weakened the habit of truth-speaking; which lowered men's reverence for the marriage-bond by placing its sanctions in a realm outside of Nature instead of in the common life of men, and by the institutions of monasticism and a celibate clergy; which stunted the moral sense of the nations by putting a priest between every man and his conscience—this system, if it should ever return to power, must be expected to produce worse evils than those which it has worked in the past. The house which it once made desolate has been partially swept and garnished by the free play gained for the natural goodness of men. It would come back accompanied by social diseases perhaps worse than itself, and the wreck of civilized Europe would be darker than the darkest of past ages.—*Nineteenth Century.*

LIEBIG'S SCIENTIFIC ACHIEVEMENTS.

By Prof. MAX VON PETTENKOFER, Professor of Hygiene in the University of Munich.

LIEBIG was one of those happy but exceptional individuals who feel their future course marked out for them by Nature from their earliest days. When at the gymnasium at Darmstadt, he had so decided a predilection that, when asked by his professor how he employed himself out of school-hours and what he meant to be, he at once answered, "A chemist." Soon afterward, at the age of eighteen, we find him first at Bonn, and then at Erlangen, where he graduated, and in 1822 he published his first chemical work.

It is interesting to observe a mind like Liebig's in its scientific-swaddling clothes. In Büchner's *Repertorium für die Pharmazie*, vol. xii., may be found "Some Remarks on the Preparation and Composition of Brugnatelli's and Howard's Fulminating Silver," by Mr. Liebig, chemical student at Darmstadt. Prof. Kastner adds: "These first proofs of the experimental diligence of a young chemist are commended to the reader's indulgence," etc. Anything written by Liebig no longer needs introduction nor indulgence, and he wrote even then as he wrote at last, and as a man must write if he wants to state facts without flourishes. He says, "I have prepared large quantities of fulminating silver according to this prescription during two years, and it has never once failed." Then follows a concise and telling criticism of the older methods, and a description of his own, in which the acute observation, the clearness and simplicity, by which Liebig was afterward distinguished, are conspicuous, and compare favorably with the appendix by which Kastner thought to add weight to the treatise.

A year later we find Liebig at Paris, first in the laboratory of Thenard, then with Gay-Lussac. While at Erlangen he saw that he must complete his studies at Paris, and received a traveling stipend from the Grand-duke of Darmstadt for the purpose.

Thenard, a Frenchman, was the author of the best text and handbook of theoretical and practical chemistry at that time. The most interesting and important researches were then being carried on in France by him and Gay-Lussac, especially in organic chemistry, in which direction young Liebig's tastes lay. Gay-Lussac had the spirit of a pioneer, and was equally familiar with chemistry and physics. It was he who first discovered the nature of prussic acid, recognized cyanogen as a radical composed of carbon and nitrogen, but which, in combination, plays the same part as the simple elements chlorine, bromine, or iodine; he

had discovered that all gases unite chemically in simple proportions, one to two, one to one, or two to three, and so forth, and that the specific gravity of compound chemical combinations in a state of vapor supplies a check in analysis which became of the greatest importance to organic chemistry. Gay-Lussac had also invented the moist silver test, so called, which is now used in all mints as the only legal one. He had also materially improved and completed the elementary analysis of organic bodies begun by Lavoisier, and performed many other services to science.

Liebig would probably have preferred to become the pupil of Gay-Lussac at once, but he did not at that time take any young men into his laboratory. Liebig, however, succeeded in gaining entrance to Thenard's, at the École Polytechnique, where he worked on at fulminating silver, a preparation which played a part in his destiny, for an unpleasant explosion in the house of his principal, an apothecary at Heppenheim, speedily diverted him from the pharmaceutical career on which he entered on leaving the gymnasium. The same preparation was the means of introducing him to the sitting of the French Academy of Sciences of 28th of July, 1823, which proved to be of the greatest importance to him. He gave a lecture on the analysis of Howard's fulminating silver and quicksilver combinations. When the sitting was over, while packing up his preparations, one of the members of the Academy accosted him, and most kindly inquired about his studies and plans. The stranger invited him to dine with him in the Palais Royal, but, either from shyness or inexperience, Liebig omitted to ask who he was. There, however, he made himself known; it was Alexander von Humboldt, who had just returned to Paris after a long absence in Italy. He introduced his young countryman, to whom he at once took a great liking, to his friend Gay-Lussac, for he knew from experience the benefit of working with him. In 1804 he had published memoirs in conjunction with him on the analysis of the air, and had afterward worked with him on the proportions in which gases combine chemically.

The time spent with Gay-Lussac was the bright spot during Liebig's student-years. How these two gifted men must have enjoyed each other's society may be imagined. The one was about forty-five, in the very prime of his powers, and had attained the highest position, a tree laden with precious fruit; the other was scarcely twenty, in the bloom of youth, a sapling full of promise, whose future might be even then anticipated, and was anticipated, by himself. Liebig once related of Gay-Lussac that when they had made an interesting discovery, or completed a difficult analysis successfully, he had often taken hold of him and danced round the table with him in the laboratory.

The kind of reports that Gay-Lussac must have given to his friend Humboldt of the young Darmstadt chemist may be imagined, and we shall not therefore be surprised that on Liebig's leaving Paris, in 1824, Humboldt recommended him so highly to the Grand-duke Louis I. that, in the same year, without taking the vote of the university, he appointed him Professor Extraordinary of Chemistry at Giessen. Neither need we be surprised that he was regarded by his older colleagues as an upstart and *protégé*, and that he did not find much support in reforming the chemical school and faculty.

But Liebig overcame all difficulties. Two years later he was made Ordinary Professor of Chemistry. He made the best arrangements that he could for himself and his pupils, to a great extent at his own expense. His reputation increased rapidly, but it was not till it became so great that young chemists came to him from all parts of Europe that the Government resolved to build a larger chemical laboratory on the Selterser Berg, outside the gates of Giessen.

To describe Liebig's scientific labors from 1824 to 1851 at Giessen, and from 1852 to 1873 at Munich, would be a task beyond our limits. All that can be done is to seize on some salient features to give an idea of his method of working.

His labors may be divided into two parts, both as to time and subject: the first, from 1824 to 1839, when they were mainly devoted to pure chemistry; the second, from 1840, when his attention began to be directed to the application of chemistry to agriculture and physiology; there was, however, much preparation for this in the first period, and researches in pure chemistry occur also in the second.

There was scarcely a branch of chemistry to which Liebig did not devote attention, and which was not enriched by him. Except Berzelius, I know of no chemist who pursued so many investigations. The *Annals of Chemistry and Pharmacy*, edited by him and others, contain more than two hundred treatises by Liebig on the most various branches of pure and practical chemistry. Far be it from me to estimate a scientific man by the number of his writings, but, considering the quality of Liebig's, their number is the more remarkable.

Great as were his services in every department of chemistry, it is organic chemistry that is the most indebted to him—indeed, he is often called the father of it. If the foundations had been to some extent laid before, it cannot be disputed that Liebig did more than any other chemist toward building up the structure.

Animal or vegetable substances, or organic matter, had often been the subjects of chemical researches when Liebig entered the arena of science, and it is known that all of them, unlimited as is their number, contain carbon, hydrogen, nitrogen, and oxygen, in certain proportions; but, as their origin in plants and animals was supposed to depend on other than chemical forces, their chemical relations to each other, and to inorganic mineral matter, were supposed to be different also. The vital forces under the influence of which all these organic matters originated were held to impress on them a peculiar and mysterious stamp.

The conviction arose very early in Liebig's mind—it may almost be said to have been born with him—that, even if there were any generic difference between organic and inorganic matter, so far as the vital forces were subject to chemical laws, no chemical difference existed. He was convinced that there could be but one chemistry, and considered it to be his mission to bring organic and inorganic chemistry into scientific harmony. His experiments on fulminating oxide, which he and Gay-Lussac recognized as a combination of cyanogen and oxygen, led him to this path; he then discovered the corresponding sulphuric combination of the compound radical cyanogen to be sulphur cyanide, and traced the products of decomposition in melon, cyanic oxide, melam, and other bodies.

Graham had shown that among the mineral acids there are some bases—phosphoric acid, for instance—which are saturated by one, two, or three equivalent bases; Liebig proved that it was the same with the organic acids having several bases.

The nature of certain neutral organic matters—alcohol, ether, and many of the volatile oils, generally regarded as being of an almost mysterious character—was the most obscure, and differed most essentially from the mineral substances. Liebig sought to throw light on their nature and composition, particularly by trying the effect of simple organic matters on them, such as bromine and chlorine, and he frequently directed the attention of his pupils to it. In this way a number of remarkable substances were discovered, which were afterward turned to all sorts of practical uses, although they had been discovered with no other idea than their scientific value. Thus chloral was discovered by Liebig several decades before Liebreich found out the narcotic properties for which it is now manufactured wholesale. The names given to these products by Liebig showed the exclusively scientific aims he had in view. Thus, by the word chloral he meant to indicate that it was produced by the action of chlorine gas on alcohol. He wished not only to think in chemical formulas, but, when possible, to express himself in them also.

These researches appeared at first to the multitude like useless chemical child's play, and to this his unusual nomenclature may have contributed. When, for instance, he had succeeded in producing what he considered a very important preparation, alcohol detached from hydrogen, he called it aldehyde, an abbreviation of alcohol *dehydrogenisatus*. This queer-sounding name called forth horror and ridicule among those who were accustomed to hear newly-discovered minerals called after the places where they were discovered, the discoverers, or some celebrated personage, as Scheele's or Schweinfurt green, or Prussian blue. Had he called aldehyde Parisin, Gay-Lussacin, Giessenin, or Berzeliusin, nobody would have been scandalized.

For Liebig, the only distinction between inorganic and organic chemistry was that the former was concerned with simple radicals, the latter with compound. An investigation in this direction, which he conducted with his friend Wöhler, led the way for others. Wöhler had been a pupil of Gay-Lussac and Berzelius, and in these general scientific questions he was on an equality with Liebig. Liebig was doubly fortunate in having had a teacher like Gay-Lussac in his youth, and a friend like Wöhler for the whole of his life. They made experiments together on oil of bitter-almonds and benzoic acid, and discovered the first radical consisting of three elements, the basis of a series of combinations to which they gave the name of benzoyl (basis of the benzoic series). It was demonstrated that a certain group of atoms of carbon, hydrogen, and oxygen (14 C + 5 H + 2 O) contains benzoyl in a long series of combinations. Benzoic acid was benzoyloxide; oil of bitter-almonds, hydrobenzoic acid; further, benzoyl chloride, benzoyl bromide, benzoyl iodide, benzoyl cyanide, benzoyl sulphide, etc., were exhibited, in which the simple radical benzoyl was found as unchanged as arsenic, or any other simple element in arsenic oxide, arsenic hydride,

arsenic sulphide, etc., and can be eliminated from it.

Berzelius, who, even when treating of chemical achievements in his annual reports, was wont to express himself in measured and stately phrase, was betrayed into unusual warmth by this discovery, and says in a letter (vol. xxvi. of Poggendorff's Annals):

"The facts demonstrated give rise to so many considerations that they may be called the dawn of a new day in vegetable chemistry. I therefore suggest that the first compound radical, consisting of more than two simple bodies in chemical combination, be called Proin, from πρωϊ, dawn, daybreak, or Orthrin, from ὀρθρός, early twilight."

Berzelius had almost turned poet.

If the theory of organic radicals seems to be, to a great extent, superseded by her blooming daughters, the older type, and the modern structural chemistry, this does not invalidate Liebig's services to organic chemistry, for the period when the radical theory prevailed was one of great progress; it was in fact a mother, whose features are to a great extent reproduced in those of her daughters. Every theory which leads to discovery and research has its value; thus the Phlogiston theory of Stahl in the last century gave an impetus to progress, although, before its close, it was forever exploded by Lavoisier. Even the present doctrine of the chemical structure of combinations and the arrangement of atoms is certainly not the last word in organic chemistry, and I doubt if it will prevail much longer than its predecessor the Type theory. I am not sufficiently versed in modern chemistry to form an opinion, but I should not be surprised if at last the various theories, which are all daughters of the radical theory, should, so to speak, return to their mother's bosom, somewhat altered, perhaps, and rich in experience and achievements.

When we consider the numerous researches in organic chemistry which Liebig made alone or with others, we cannot be surprised that he was looked upon as preëminent in this department, and can only wonder that he found strength and time for the gigantic labors it involved.

The strength was the gift of Nature, but the time was the result of his diligence and method. Liebig's understanding was as acute as his imagination was fertile, yet he was by no means visionary. Intellect and imagination were harmoniously blended in his character, and had, perhaps, the chief share in his success both in science and life. You should have seen Liebig examine a substance or watch a chemical process; he was sharp-sighted in every sense of the word. I was once present when a crystalline, colorless body was brought to him, which had just been found in pyroligneous acid, and the composition of which had not been ascertained. It smelt like creosote, and, as the presence of that body in pyroligneous acid had not hitherto been detected, Liebig was interested in it. He laid it on a platina plate and held it over a flame; it melted, steamed a little, and when removed from the fire resumed a crystalline form. Liebig said at once, "I think it is pyrogallic acid, for that melts and crystallizes as this does." It was a bold conjecture, and one that an orthodox chemist would not have ventured on. For it was not known that pyrogallic acid occurred in pyroligneous acid, and it is without smell, or at any rate has not the least smell of creosote, while so many bodies melt and crystallize afterward that more than ordinary acuteness is required to detect peculiarities which furnish hints for diagnosis. The substance was dissolved in water and tested with the reagents for pyrogallic acid. All the reactions occurred; there was no doubt that it was pyrogallic acid or something closely allied to it. All this occupied less than ten minutes, and further investigation confirmed Liebig's opinion, for, though not pyrogallic acid, it was catechuic acid, which is closely allied to it.

It was only natural that one who so often found that he saw farther than others should not readily give up anything that he had taken into his head, even if experiment did not at once confirm his views; no man is infallible, and Liebig was now and then mistaken. When he thought that a substance contained this or that, he often gave it to one of his trusted pupils to experiment upon. If he did not at once find what was expected, Liebig was apt to doubt his pupil's skill rather than his own conjectures. He would naïvely say, "But you must find it." If unable to do so, he sank still lower in his master's estimation, but rose again as quickly if he produced indisputable evidence against his opinion, or some other explanation. As was natural, the tenacity with which he held to his own opinion increased with years. Learned men in other departments, particularly men of book-knowledge, had much ado to stand their ground against the ideas on their special subjects which Liebig would throw out in conversation. Though they might argue the point with faultless language and logic, he was seldom convinced. He would say, "The man is much more learned than I am," or, "He knows a great deal more than I do;" but he still

held to the opinions suggested by his own common-sense.

In addition to his mental powers and quick perceptions, Liebig's methods greatly conduced to his rapid progress. He saved himself and others a vast deal of time by the invention of good methods in his experiments. Of those he applied, perfected, or invented, the elementary analysis of organic bodies takes, perhaps, the first place, particularly the determination of carbon and hydrogen. Before the introduction of Liebig's methods, an organic elementary analysis was one of the most difficult tasks of the analytic art, and was only attempted by the greatest masters. Liebig had seen the process in the laboratories of Thenard and Gay-Lussac, and had followed their plans. He, of course, mastered the difficulties under their guidance, but he must have found them very troublesome, and still more so the time they consumed. When he began his ardent labors at Giessen, and would fain have made experiments on the carbon, hydrogen, and nitrogen, in all organic bodies, he must have been much impeded by the time and apparatus required. He saw that he must make it a quick and easy process if progress was to be made in organic chemistry. This purely technical task occupied him for years, and he succeeded to a surprising extent. The apparatus was made by degrees so simple and unfailing, that dexterity in mineral analysis was far surpassed. Any chemist was now enabled, especially after the equally expeditious method of determining nitrogen had been introduced by Will and Varrentrapp, to make several combustions in a day.

The simplification of elementary analysis has been of no less importance to organic chemistry than modern methods of transit to commerce. Questions as to the percentage of the component parts of organic bodies could now be readily answered, and were no longer a tedious hinderance to the experimentalist. The five-ball apparatus which Liebig, who was himself an expert glass-blower, learned to make out of a few glass tubes, in which the carbon in organic matters was absorbed and weighed as carbonic acid, became the sign and symbol of the Giessen school; the students wore it on breast-pins and buttons, and it figured under likenesses of Liebig. It has contributed no less to researches into the composition of organic bodies than good telescopes to viewing the heavens, or good microscopes to the investigation of the minutest atoms.

Liebig's career as a teacher does not come within the sphere of his scientific achievements, but his school is inseparable from his works and from the development of organic chemistry. He had felt the need of higher education, the shortcomings of the schools of his day. He found what he wanted at Paris, and he made accessible to all in Germany what he had to thank his good fortune for through meeting with Alexander von Humboldt. The establishment of the chemical laboratory at Giessen must be considered an "epoch-making" fact of modern times. Liebig thereby led chemistry by the shortest route from the professor's chair into the sciences and practical life. How great the activity which prevailed in those chemical halls on the Selterser Berg, how unceasing the labor going on there! The most important objects were pursued together with the most commonplace, the future practical chemist and the future professor worked side by side, and now and then some chemical bungler among them. All the dialects of Germany, all the tongues of Europe, were mingled together, that of England in one of the halls predominating; yet there was no confusion, every one felt that he had lofty ends in view, he was serving science, he was a pupil of Liebig's.

And how stimulating was this concourse of aspiring youths under such a master! For every one in a scientific or experimental difficulty—in chemical distress—he had some good advice, some happy suggestion, to help him on his way and float his craft again. No one who had witnessed these labors, as earnest as they were cheerful, in this chemical beehive on the Lahn, could wonder that at one time every one who aspired to higher education in chemistry thought it necessary to make a pilgrimage to Giessen, and the reputation of Liebig's school became so high that it was a recommendation merely to have been there.

Liebig also deserves admiration for having persisted in his methods of teaching. Like every one who is in advance of his age, he at first met with opposition. Some few professors of chemistry had seen before that the chemical students of the universities should practise in the laboratory; but they were not supported by public opinion, and not strong enough to overcome it. I well remember what my old teacher, Johann Nepomuk von Fuchs, used to tell me of the days when he was Professor of Chemistry at Landshut, about 1820. He tried to keep up a small practical school on the most modest scale, but his colleagues considered it useless waste of materials and wear and tear of the apparatus, and the few students who attended it were laughed at by their

comrades for supposing that the professors would show them the right methods, and so turn them into professors too. Goethe makes Mephistopheles say to Faust, "You must not give the fellows the best of what you know." Liebig reversed the dictum, saying, in effect, "All that I myself can do the fellows, too, must learn."

When the Giessen school was at the height of its fame, many of the university professors were of opinion that Liebig was making a mistake, and lowering the dignity of science. One distinguished chemist and professor seriously thought that he was simply ruining the prospects of some dozen young men every year by putting it into their heads to become chemists, for what was the use of so many of them? They would never be able to find anything to do, and would take to evil courses. But Liebig was not to be turned aside from his own path, and before long, numerous as were his pupils, he was unable to supply the demand for chemists from his school, and it became necessary to establish similar nursery-grounds, or forcing-houses, as they were called, elsewhere.

Liebig from the first acted on the principle of making his pupils chemists in a general sense, without regard to special application—of putting them in possession of knowledge which they could apply themselves. But neither was this in accord with the ideas of the time. Just then technical schools were being established for teaching such departments of natural science as were applicable to particular trades. In a school of practical chemistry the future potter should make clay his study; the brewer, malt and hops; the tanner, skins and bark; the dyer, dyes; the agriculturist, soils and manures, and so forth; but should not be troubled with things that he did not expect to turn to any practical use. Liebig was strongly opposed to this thoughtless utilitarianism. Only to learn just that of science which you expect to turn to account is as absurd as if you should learn just those words of a language which you expect to use.

People engaged in technical undertakings on a large scale soon found out that Liebig was right. Many applications were made to him not only for teachers of chemistry, but for technical chemists—not merely for chemical works, alkali-works, etc., but for paper-mills, dyeing-works, breweries, etc. One of the largest firms of English brewers wished to engage a chemist for special researches into the process of brewing and fermentation. Liebig thought it right to state that he had not just then any pupil who had paid the least special attention to those subjects. The house wrote back that that was of no moment; if the young man was acquainted with chemistry in general, he could learn about brewing and fermentation best with them; and the young man, who had gone through a course of chemical study, but whose knowledge of brewing was probably confined to drinking beer at the cellar near the Giessen laboratory, became an eminent brewer.

Liebig always regarded his career as an instructor with great satisfaction, and could truly say, a few years before the close of his life:

"I entered the realm of Science at the time when organic chemistry was being developed, and had for thirty years the rare good fortune to see around me a large number of clever and aspiring young chemists, many of whom are the ornaments of the chairs of chemistry in nearly every country of Europe. With their help, and, I must add, together with my friend Wöhler, we succeeded in carrying on numerous researches, and in ascertaining a multitude of facts which must be considered the groundwork of the organic chemistry of the present."

Liebig's literary labors do not come directly within my province, any more than his career as a teacher; yet my sketch would be incomplete without mention of the *Annals of Chemistry and Pharmacy*, and his "Letters on Chemistry."

When Liebig appeared there was no paper in Germany specially devoted to chemistry. It was then for the most part an adjunct of pharmacy, in which the results of chemical science were of immediate use. The apothecary used often to play an important part, not only in little bourgeois epics, like "Hermann and Dorothea," but in chemistry and natural science in general; and Liebig's first writings appeared mostly in the *Magazine for Pharmacy*. In 1832 Liebig and Geiger established the *Annals of Pharmacy*, which became Liebig's organ. In 1840 it took the title of *Annals of Chemistry and Pharmacy*, in order, as Liebig said, to make it more in accord with the contents, and Wöhler became one of the editors. For forty-one years Liebig was the main support of these Annals, which were mostly called, and are still, "Liebig's Annals," and they form an inexhaustible and indispensable repertory of information for any one who wishes to make researches in any department of chemistry.

The "Letters on Chemistry" originated in a series of articles in the *Augsburger Allgemeine Zeitung*. They need but to be mentioned to recall to the mind of every educated man a matchless example of the art of popularizing

pure science for the widest circle of readers. They are also indispensable to the expert, for the author constantly used them, as he himself stated, to illustrate his views on chemistry, agriculture, and physiology. He expended great pains upon them. Not long before his death, he wrote to one of his pupils who had published a small popular work:

"The style of your book is excellent; it is really a masterpiece of simplicity and clearness. To most readers it may appear off-hand, as many have said of my chemical letters, but I am sure that you have expended much care and attention on the composition, as I did on mine; there is an art in simplicity and freshness of style which, however, must be kept out of sight."

Liebig thus gave the highest praise that he could bestow on a popular work.

It was the comprehensive view which Liebig took of chemistry which naturally turned his attention to agriculture and animal physiology. Having devoted more attention than any other chemist to the materials of organic Nature, he wanted to observe them in the laboratories in which they were produced, to study the part they played in the economy of Nature. It is well known that he became a pioneer in these departments and gave a great impetus to the study of them. I will confine myself to the mention of a few of the chief points.

What is called Liebig's agricultural chemistry may be divided into two periods—the first from 1840 to 1846 at Giessen, the second from 1856 to 1862 at Munich. His researches in vegetable and animal physiology were first made known in a work which appeared in 1840, called "Chemistry as applied to Agriculture and Physiology." This step involved so many consequences that I must enter a little further upon the subject.

In 1837, at the meeting of the British Association held at Liverpool, Liebig was requested to draw up a report on the existing state of knowledge of organic chemistry. He consented, but proposed that the French chemist, Dumas, should join him in the work. Dumas, however, does not seem to have agreed, and in 1840 Liebig's book appeared. It met with unusual success; six editions were called for in six years, and it excited great attention, so great that in 1841 Dumas felt constrained to put forth something similar in French, and formally indorsed Liebig's main principles, although some of them were much disputed. He said, "Elles appartiennent à notre école, dont l'esprit est venu s'exercer sur ce terrain nouveau."

But the success of the book in another respect was not so great—in its effect at first upon agriculture and physiology and their representatives. They almost all regarded Liebig, with his notions and theories, as an interloper, who must be driven back into his own territory; and a contest began. Even some distinguished chemists did not approve of Liebig's having, like an ambitious ruler, thus extended his domain. Berzelius from the first was doubtful, and a few years later was quite at enmity with Liebig about these theories of probability, as he called the application of chemistry to things of this sort. In his annual report of 1841, Berzelius said of Liebig's book, that it was written with all the ability to be expected from so distinguished an author, but made no secret of his opinion that Liebig had erected a structure that was already tottering to its fall.

The more critical, and even hostile, was the attitude of the agriculturists, physiologists, and chemists, the louder was the applause of the public at large; but whether it was entirely satisfactory to Liebig I cannot say, for no one of the applauding multitude could bring Berzelius to another mind, invalidate the experiments of Braconnot, or the objections of Boussingault, could convince the skeptical farmers, or put the polemical physiologists to silence. It appears to me that Liebig must have felt rather isolated at this period, for even his best friends saw that in the lofty flights to which his imagination had led him he had often asserted more than he had proved, and that the prosaic task of proof had yet to be entered upon. He had thus raised up a host of opponents who were by no means to be despised, and was left to his own resources in dealing with them. The way in which he succeeded, in course of time, is worthy of all admiration.

At the time when Liebig was called upon to undertake the work which caused so much excitement, his powers were in their prime. When such a man as he was takes a general survey of things, his field of vision may be expected to extend beyond the usual range. What was the main thing that Liebig discovered?

He never claimed to be the first to make chemical experiments in agriculture. On the contrary, in the dedication of his book to Alexander von Humboldt he says:

"There is one part of the little book which I take the liberty of dedicating to you, of which I scarcely know whether it is really mine. When I read your introduction to Ingenhouss's work on

'The Nourishment of Plants' of forty-two years ago, it always appears to me as if I had but carried out and tried to prove the views, therein expressed, of the most eminent naturalist of this century."

What was it, then, which occasioned all this commotion?

In my opinion, it was not the facts adduced, which were mostly known before, but the idea by which Liebig's mind was so possessed, that, of all life upon earth, vegetable life alone has any affinity with lifeless, inorganic Nature; that vegetable life, by the aid of inorganic mineral matters, forms new and complex forms of organic Nature; that animal life derives its life solely from vegetable life, and the animal, under the influence of the oxygen which it inhales, again resolves these combinations into the simple, inorganic mineral matters, carbonic acid, hydrogen, ammonia, etc., out of which vegetable life combined them by the separation of oxygen in the air. It was this simple rotation of matter in animated Nature which excited Liebig and others, and it soon found favorite popular illustration in the little aquariums which were called "Liebig's World in a Glass Case."

Liebig embraced this idea enthusiastically, and it raised him to a height from which prospects opened out before him as yet concealed from others, and it induced him to publish many things which, having been seen only afar off, wore a different aspect when viewed more closely. He began to bear down all obstacles in his path at the risk of being considered a ruthless destroyer.

The method pursued by Liebig in his agricultural chemistry was slow and laborious; it would have taken any one else three times as long. The first great task was the examination of as great a variety of plants as possible from various places, their component parts, and those of their ashes. He did not place much value on analysis of soils, which had been considered so important, especially how much humus a soil contained; what he wanted to know was the effect of every plant on the soil on which it grew. It was soon found that the ashes of all plants yield qualitatively the same mineral constituents, but that every species yields its own peculiar ashes, for different species growing side by side on the same soil absorb its mineral elements in very different proportions.

Liebig sent out letters asking for analysis of ashes in all directions; and, in order to facilitate the task, his assistants, Will and Fresenius, worked out and published an excellent method of obtaining them. In a comparatively short time thousands of results were obtained.

Liebig now put into practice the results of the discovery that every species of plant takes from the soil a certain quantity of mineral matter, in certain combinations, which is found in their ashes; and his opinion that plants derive the rest of the material required for their growth from the atmosphere, in the form of carbonic acid, hydrogen, and ammonia, by the aid of their leaves and roots. He asserted that, in order to make a cornfield perpetually productive, you have only to restore to it the mineral matters withdrawn from it by the harvest; the atmosphere and the conformation of the soil, regulated by the mechanical part of farming, will take care of the rest.

A soda-manufacturer at Liverpool was commissioned by Liebig to make arrangements for supplying the farmers with mineral manures for wheat, rye, oats, clover, potatoes, etc. They were prepared according to a method invented by Liebig, the essential feature being that the nourishing salts, too readily soluble in water, were made less soluble by being mixed with carbonate of lime, that they might not be carried off by the rain out of reach of the sprouting seeds.

Liebig was thoroughly convinced of the correctness of his mineral theory, and as thoroughly of the efficacy of his mineral manures. It did not, however, turn out as he expected. His genius was to be sharply put to the test.

The English farmers found no result from the artificial manures, left off buying the useless stuff, returned to their old manures, and the works at Liverpool were given up. Indeed, Liebig was compelled to admit, from his own farming experiments at Giessen, that his mineral manures did not render a sterile soil essentially more fertile. One ray of hope appeared after years of non-success; the crops obviously increased a long time after they had been manured. But this was only another puzzle.

Meanwhile, all his opponents bestirred themselves, not only to demonstrate the uselessness of mineral manures, but to upset the mineral theory altogether, and to show that, in order to obtain practical results in farming, you must go to work in an entirely different way. First and foremost was an English land-owner, Mr. Lawes, who, together with a chemist of the name of Gilbert, made experiments with various manures which they manufactured. It was shown that the more soluble a manure is, the greater the effect produced, that the produce of a field often increases enormously if only common salt be put upon it, especially superphosphate; but

that, above all, in order to obtain large crops, ammonia, or ammoniacal salts, or, as at length it was briefly called, nitrogen, must be applied, and for a time the value of a manure was tested solely by the amount of nitrogen it contained, while, according to Liebig's theory, the atmosphere was the all-sufficient source of ammonia. His opponents rallied under the banner of this party, who were called nitrogenists, and they thought that they had driven Liebig forever out of the field.

But in spite of all, Liebig remained strong in faith in his theory, and would not yield to want of practical success. Now and again, he entered into vehement polemics, especially against the validity of Lawes's experiments as opposed to his theories, but without success. Pusey, the President of the English Agricultural Society, took the part of the practical man, Lawes, all the more decidedly.

The readers of "Chemistry as applied to Agriculture and Physiology" became fewer and fewer, and after 1846 no new edition appeared.

But it must not therefore be supposed that Liebig's doctrines were refuted, for by means of his numerous pupils they had made their way into almost all agricultural schools, partly even into practical farming. Many experiments were made at the agricultural chemical stations, the first of which was in Saxony, and they proved more and more the correctness of the scientific principles which led to the artificial manures, even though they had not proved useful, and Liebig's mineral theory would have held its ground, even if he had given up his researches in this direction or had departed this life. But it was reserved for him, with his own hand, to put the keystone to the structure he had raised, and it was at Munich that it was to be done.

After 1845, Liebig had occupied himself more and more at Giessen with the second part of the task he had set himself, the application of chemistry to animal physiology; and at the close of 1851, when I was sent by King Maximilian II. to negotiate with Liebig about coming to Munich, he was in the midst of these labors. He had declined so many invitations that but little hope was entertained of gaining him for Munich. We succeeded, however, and to his honor be it said, he did not embarrass the negotiation by exorbitant demands, but only stipulated that he should not have the conduct of so large a laboratory as at Giessen, that he might have more leisure for his own pursuits. He removed to Munich in 1852, at the age of forty-nine.

After a time he resumed his agricultural experiments, and directed them to discovering why his mineral manures did not produce the desired effect. At length he succeeded. He proved to demonstration that all cropping is robbery of the soil; that if every particle of mineral matter is not restored to it by some sort of manure after every crop, it is only a question of time when a field will cease to be productive.

At length it became clear to him that the clods crushed by the farmer, the particles of soil, play a much larger part in the nourishment of plants than had been supposed. The idea had been that besides the nourishment in the form of air, that only which was dissolved in the moisture contained in the soil, even if dissolved with difficulty, contributed to the nutrition of the fruits of the earth. The good effect of allowing land to lie fallow was supposed to consist in the gradual decay and solution of certain constituents, and it was thought that it was only to open the soil, as it was said, to make its elements soluble, so that they might be sucked up by the roots of plants. The growth of land-plants was supposed not to differ from that of water-plants. Liebig discovered that with field-crops, and land-plants in general, it was just the reverse; that they live upon matters which were once dissolved in water, but again absorbed from the water by the soil and rendered insoluble. He ascertained the absorbent power, the point of saturation, of various soils for the mineral food of plants dissolved in water, and found the greatest differences, not only between various soils, but in the same soils for various substances. He discovered, for instance, that a certain quantity of ammonia, dissolved in water, penetrated to a depth of ten centimetres in passing through loam, an equal quantity of potash to eleven, and an equal weight of phosphate of lime, dissolved in water containing carbonic acid, penetrated to a depth of twenty-three centimetres and a half, and saturated the soil.

The part played by water in the soil is therefore twofold. It has not only to furnish plants with their normal quantity of water, and to restore the loss by exhalation, but also to convey the nourishment to the soil from which it is abstracted by their roots. Just as the roots are able to extract the insoluble mineral matters from the soil, they also extract from it moisture hygroscopically combined with it, which is then, to a certain extent, restored by the atmosphere, even without rain.

The absorbent quality of the soil for matters of this kind dissolved in water was not discovered by Liebig; Thomson and Way had long before

observed this property of the soil and other porous bodies; but neither they nor Liebig had hitherto turned it to account in agriculture; it must have been deemed injurious rather than beneficial, because it had been held that what was wanted was to make the nourishment in the soil not insoluble but soluble. It was to Liebig that the principle first occurred that the soil, like water, only just in the reverse way, could be saturated with matters to a certain extent without chemically combining with them; that as, for instance, common salt in water becomes fluid, and mixes with it without altering its nature, or chemically combining with it, so the nourishing mineral matters dissolved in water again become solid in contact with earth, and go into the earth without change in their chemical composition. Liebig perceived now that land-plants extract the matters by means of their roots from the soil which the soil has abstracted from water and rendered insoluble.

He now saturated unfruitful peat-earth with mineral matters containing nourishment for plants. Water filtered through such earth abstracted nothing from it whatever, but grain, peas, beans, etc., flourished luxuriantly, and bore over one hundred-fold. Their delicate roots could abstract what water could not.

Liebig knew now why his mineral manures produced little or no effect. With great chemical shrewdness he had rendered certain substances, particularly potash and the phosphates, almost insoluble in water, and prevented them from passing into the absorbent soil. When he perceived his mistake, it was as if scales had fallen from his eyes: he saw clearly before him the end at which he had so long been aiming.

In 1862 his great work, in two volumes, appeared: "The Chemical Process of the Nourishment of Plants and the Natural Laws of Agriculture." By this Liebig completed and crowned his science of agriculture; his doctrines are now everywhere acknowledged, and no thoughtful farmer supposes that he has only to lay on superphosphate, nitrogen, or guano, to make his fields fruitful forever. The object is now to apply Liebig's theories by the best methods. The German land-owners gratefully acknowledged this a few years ago by founding the Liebig Institute.

How deep was the impression made upon Liebig's mind by these discoveries is clearly shown by his own words. He says in his introduction to his work of 1862:

"It was a real and perpetual grief to me that I could not discover why the effect of my manures was so tardy; I saw everywhere, in thousands of cases, that every one of their component parts produced its effect alone, yet when combined, as in my manures, they produced none.

"At last, three years ago, after submitting all the facts, step by step, to fresh and careful experiment, I discovered the reason. I had sinned against the wisdom of the Creator and suffered just punishment. I thought to improve upon his work, and fancied, in my blindness, that in the wondrous chain of laws by which life is ever maintained and renewed on the surface of the earth, one link was wanting which I, a weak and helpless worm, was to supply. It had, however, been provided for; but in so wonderful a manner that the existence of such a law had hitherto been unsuspected by man's intelligence, numerous as were the facts that indicated it; but facts, though they speak truth, are dumb, or one hears not what they say, when error drowns their voice. So it was with me. The alkalies, I thought to myself, must be made insoluble, or the rain will carry them off! I did not then know that the soil holds them fast, so soon as solutions of them come into contact with it, for the law to which my experiments in agriculture have led is as follows: Organic life is developed on the crust of the earth under the influence of the sun, and the great Architect gave to the ruins of this crust the property of attracting and holding fast all those elements which serve for the nourishment of plants, and thereby of animals also, as the magnet attracts and holds fast iron filings, so that no particle is lost. The Creator included in this an other law, whereby the earth, bearing plants, is a vast cleansing apparatus for water, from which by this property it removes all those matters which would be injurious to man and beast, the products of the decay of generations of plants and animals."

In glancing at Liebig's influence on animal physiology, I shall be more concise, as his method of procedure did not differ from that with agricultural chemistry. In this department also his studies were based upon exact organic chemistry. What first attracted him was the reception of organic nourishment and the reversed metamorphosis of matter under the influence of oxygen from the highly complex to the simple, to the inorganic, from albumen and fat to uric acid and urea, carbonic acid, water, ammonia, and ashes, just as he had pursued the reverse method with plants. The researches into the changes in uric acid under the influence of oxidation may be regarded as thoroughly typical of his work; like the researches into benzoin, it was undertaken in conjunction with his friend Wöhler, who ten years before had succeeded in making a synthesis of

urea from its elements, the first instance of an artificial exhibition of an organic body out of inorganic elements. The work on uric acid is a classic model to this day.

Liebig's labors in animal physiology may be divided into two parts: 1. The discovery by chemical analysis of the component parts of various organs, and excreta; 2. The endeavor to explain the chemistry of physiological processes. To the first part much has been contributed by others besides Liebig and his school. Much as these researches have extended our knowledge, they would never have received the attention accorded to the second part; this Liebig reserved to himself, namely, to explain his ideas of the significance of all these matters in the living body.

Physiology falls mainly into an anatomic-physical and an organic-chemical division. With the first Liebig scarcely troubled himself at all, and in the second he was interested purely as a chemist, but he taught the physiologists from his laboratory how to observe chemical processes in the organism, without ever having made a physiological experiment. This was at once a strong and a weak point with him. No physiologist will deny that, in spite of this weakness, he exercised an influence on the progress of physiological science. The case was much the same as with agricultural chemistry: he constructed a theory from a purely chemical standpoint, and then ap pealed to practice; but his essays in the physiological sphere were much more audacious, for he had not command of the weapons—physiological experiment; at least I am not aware that he ever himself made an experiment on a living being.

The progress of every science depends upon the discovery of facts, which may be called scientific practice, and upon the conclusions deduced from them—that is, on theory and practice. They may be compared to the army and diplomacy in statecraft. Diplomacy wages no actual warfare, but is not seldom the cause of it, and the soldiers have to make experiment after experiment, to marshal facts against facts, until it appears which side is the stronger.

In the realm of pure chemistry Liebig was both soldier and diplomatist, indeed one of the greatest generals. In the physiological sphere he was only a diplomatist, but he was the cause of many movements and conflicts, which have cleared up various points in physiology, although, when peace was concluded, some things were not settled in accordance with the original demands. The decision of Liebig's character induced him at once to state what he thought to be the case without troubling himself about other claims. Thus, for instance, it had been stated by Lavoisier that animal heat was derived from processes of oxidation, from a sort of combustion of the substances in the body containing carbon and hydrogen. Dulong and Despretz proved by experiment that this was nine-tenths true, that is, capable of demonstration. Liebig tried to prove by purely theoretical methods that all animal heat was derived from chemical processes, and did not, like many others, infer, from the experiments of Dulong and Despretz, that the other tenth was otherwise produced, for example, by nervous influences; did not even take the trouble to investigate the remaining tenth at all, but simply gave in his evidence to the opposite party, that the heat of an animal kept in a box surrounded with ice during experiment did not become diminished by one-tenth. And proof to the contrary has never yet been offered.

As is well known, Liebig interested himself no less in the nutrition of animals than in that of plants. Notwithstanding that the food of different animals and man is so various, they are chemically alike in their corporeal substance. There is no essential difference between the flesh of birds, oxen, or man; cow's milk can be substituted for mother's milk; and, physiologically speaking, there is nothing impossible in the myth that the founders of Rome were suckled by a wolf. The transmutation of matter in an herbivorous animal, when fasting, differs in no respect from that of a carnivorous animal, for so long as he does not eat he must consume his own flesh. What is, then, the common principle in the thousand kinds of food, this unity in multiplicity? The mind of man has occupied itself with these questions for ages. Just before Liebig's time, the experiments made by Magendie and others on the subject of nutrition had produced results which only seemed to render the question more obscure; but six years ago Voit said:

"This obscurity was to be brilliantly illuminated by one who is still among us. No one will accuse me of flattery if I mention the services of one living and present, for they are so universally acknowledged that they belong to history."

It was Liebig who first expressed the decided opinion that the animal must be provided by his food with the chief elements in the blood, and therewith of the body built up and nourished by it, and that its original and essential constituents are to be found only in vegetation, for the exist-

ence of the carnivora implies that of the herbivora, and the herbivora that of vegetation. Liebig said:

"The nutriment of men and animals consists of two substances, differing entirely in their composition. The one class, consisting of nitrogenous, albuminous matter, serves to make blood, and to form the solid structure of the body—these are called plastic elements of nutriment. The others, which are non-nitrogenous, fats and hydrocarbons, are like ordinary fuel, and serve only for the production of heat—they are called breathing material. Sugar, starch, and gums, may be regarded as fibres of wood transformed, and can be produced from wood. Fat stands next to coal in the quantity of carbon it contains. We heat our bodies as well as our stoves with fuel containing the same elements as wood and coal, but essentially distinguished from them by their solubility into the juices of the body."

It is upon this that Liebig's division of all nutritive elements into blood-making or plastic, and combustible or respiratory, material, is based, and from its simplicity and clearness it has been retained almost without exception to the present day, although the definition more recently given by Voit, from a physiological rather than a chemical standpoint, is also very simple. Voit classifies articles of diet, not according to their possible effects, but according to their material importance for the body, and states the question thus: What must the food contain to prevent the diminution of albumen, fats, salts, water, and oxygen, in the transmutation of matter, and what share has each article of diet in it? Both men and animals live exclusively upon the above-named materials, and consume them in the intervals between meals and when fasting. In order that food may be really convertible by and acceptable to the organism, it must, as Voit justly observes, contain also articles of luxury, that is, materials which work upon certain nerves and affect the activity of the digestive apparatus. This definition embraces not only the solid, but also the fluid and air-forming constituents of food; it is more complete and precise than Liebig's, but not so intelligible to every layman, so that Liebig's will long maintain the field with the public at large. It has, however, been proved, by experiment, that even under the greatest exertion no more blood-forming or strength-producing elements are consumed than during absolute rest, while a great deal more of the other class, the heat-producing elements, are consumed, though the heat of a healthy body is rather diminished than increased.

Another great service of Liebig's, on the subject of nutrition, is that he established the principle that it depends not only on partaking of blood-forming and heat-producing materials, but that they should be taken in certain proportions varying with circumstances. He also endeavored to settle the equivalents of different articles, as, for instance, how much hydrocarbon would produce the same effect as a certain weight of fat. He did this in his usual fashion, from a purely chemical standpoint, without even, as it were, putting a question to the living body. When, therefore, experiments were tried in accordance with these theories, many things turned out otherwise than he expected, just as the fields did not yield the results he looked for, on his experiments with mineral manures; but in spite of all this, it is surprising how much has been confirmed, and no one will dispute the services rendered in this sphere by him as a pioneer.

Liebig was much engrossed at one time with the formation of fat in the body. I cannot state the subject better than Voit has done in his lecture on theories of nutrition: "It had long been agreed that the albuminous and nitrogenous elements in the body are solely produced by albumen in the food; but great difference of opinion prevailed as to what produced fat, and yet it is very important to ascertain it. It was thought at first, and the view was entertained by two distinguished French chemists, Dumas and and Boussingault, that fat was formed solely from the fat intoduced into the body. But Liebig soon perceived that this could not be, and proved to a certainty that the fat in the food, especially in the case of the herbivora, could not produce all the fat in the body, and that the hydrocarbons had the greatest influence on the production of fat."

From these facts Liebig drew the conclusion that fat is formed chiefly from the non-nitrogenous elements in food, starch, sugar, and the hydrocarbons generally. A lively controversy sprang up between Giessen and Paris, and there was much sharp-shooting on both sides. Liebig came off victorious, inasmuch as he was correct in maintaining that the fat in the food could not, in most cases, account for the amount of fat in the body, and that the hydrocarbons were certainly concerned in its production.

It was not until experiments were undertaken with the respiratory apparatus in the Physiological Institute at Munich that other views came to be entertained. This apparatus enabled us to ascertain the exact amount of receipts and expenditure in the body during twenty-four hours,

in the form of gas, which had only been possible before with the fluids and solids; and when an exact balance had been struck, it appeared that, at any rate among the carnivora and man, fat is never produced by the hydrocarbons, not even when taken in the greatest quantity, but that it must be produced by the fat in the food and by being eliminated from albumen. Voit, by his experiments on a milch-cow, has rendered the production of fat by hydrocarbons in the herbivora very doubtful; and we are thus compelled to conclude that all fat not contained in the food, which is produced in the body, has its origin in the decomposition of albumen, and that the hydrocarbons, previously looked upon as fat-formers, only serve to prevent the fat originating in albumen from combining with oxygen, from further decomposition into carbonic acid and water, from so-called combustion. No single experiment since made has contradicted this theory; indeed, time has only confirmed it. Liebig never could reconcile himself to it; he even disputed it in his last work on fermentation and muscular force; but this does not detract from his great services on the question of alimentation, for even the modern view is but the result of the impetus which he gave to it.

Closely connected with food are Liebig's experiments on meat, which first gave us a precise idea of the chemical composition of muscle, by far the largest and most solid part of our bodily elements. One fruit of these studies is the extract of meat, which has been so much discussed, and as much overrated as underrated. Without granting that one ounce of the extract is equal to a pound of meat, or that you may turn bread into meat with it, it was a valuable gift to mankind; it has been found a welcome cordial to the traveler in the desert, the voyager to the north-pole, and our soldiers in war, and it finds a place more and more in the kitchens of the middle class. Among the luxuries which are necessary additions to our food, none is more grateful than soup, and we have the essential basis of it, only in another form, in extract of meat. Liebig occupied himself much with the physiological value of this *protégé* of his, which has become so large an article of trade.

On the whole, Liebig initiated and rendered possible a science of nutrition. It is a curious fact that his ideas have been much more tardy in making their way into the laboratories of animal and vegetable physiology than into the experimental agricultural stations which he also instituted, and which have proved so useful. Though their chief aim is practical, they sometimes contribute to the advancement of science. Farmers now go deeply and successfully into the question of the best means of feeding and fattening various races of animals. It might be no less to the advantage of the human race if experiments were tried as to the best diet for the various classes of our population.

I am well aware that I have by no means exhausted the subject of Liebig's achievements in science, but have simply indicated them; what I have said suffices to show how great they were, even though all that he did, wrote, and said, was not free from human error and weakness. We will not desecrate his memory by flattery or servile adulation—

"Es irrt der Mensch so lang er strebt."

If in some things Liebig did not entirely succeed, if he did not finish everything that he undertook, he only shared the fate of the greatest men in history, and other benefactors of mankind, but he none the less influences the present and the future. Let us rejoice in the inheritance he has left us. It is distinguished from all earthly possessions by this peculiarity, that every one may take of it as much as he will without lessening the store for the rest; nay, the more every one makes it his own, the more will it increase and multiply.

It is an old and familiar metaphor, derived from the most ancient department of practical chemistry, the production of metals, advance in which divides one great epoch of civilization from another, that every man may be looked upon as an alloy of base and precious metals, that he must be tried and purified in the fires of life and of death, and that the more he has aspired after noble ends in life the more precious will be the residuum that he leaves. Every man who has honestly pursued noble ends, leaves behind, as the flame of life expires, a grain, smaller or larger, of precious metal; few only are utterly consumed as dross in the fiery furnace of this life, but the weight of the residue greatly varies. Liebig now lies, as it were, before us on the burning, refining hearth of a ceaselessly active and noble life—a mighty deposit of silver which coming generations may yet gaze on with admiration.—*The Contemporary Review.*

ONE PER CENT.

By Prof. BONAMY PRICE.

ONE per cent. has now reigned supreme in the market for discount for the space of a whole year. The Bank of England, indeed, has thought it to be inconsistent with its dignity or its policy to accept so mean a return for its favors in lending, and has consequently laid down two per cent. as its minimum rate for discounting. By such a proclamation, it virtually announced its intention of withdrawing from the ordinary banking market, and the competition it involves with private banks, so long as the present condition of the financial world continues: and it has probably found compensation in applying its funds to investments of a more permanent character. In the regular money-market one per cent. has been only an average for the twelve months. For a considerable time the rate for lending sank to one-half per cent.; and even on such infinitesimal terms the bankers have at times found it hard to reap any profit from their deposits.

Every one remembers the agitations associated with seven per cent.—the trepidation of merchants, the apprehension of losses in business through oppressive charges for interest, the anxieties for what the future might still have in store, the general uneasiness through the commercial and banking communities. If only a moderate rate could be reckoned on as steady, how happy would every one have been! what visions of good and stable profits would have gladdened the mind of every trader! how deep would have been the conviction that the country was eminently prospering! The thought of a continuous one per cent. would have been felt too presumptuous to be indulged; the contrast with the feelings under seven was too violent.

Yet what are the facts and feelings of to-day? Is every merchant, every manufacturer, rejoicing in the pleasant terms on which he obtains the accommodation so necessary for his business? Are the reports from every great centre of industry and trade full of exultation over the bright days and cheerful sensations which gladden commercial life? Are our harbors thronged with ships waiting to relieve the loaded warehouses of their stores, and our railways distributing swollen dividends, gathered from endless trains distributing the countless products which an energetic and thriving industry is everywhere creating? Are laborers asked for on every side and every employer eager for some services which will raise him to fortune? And is the Chancellor of the Exchequer panting to enjoy the enviable pleasure of developing a brilliant budget to a delighted House of Commons? Alas! no such sounds or sights meet our ears and eyes on any side. The fond thoughts associated with an easy money-market are found to be coupled with realities of a very different order under the supremacy of one per cent. In what quarter is there rejoicing? What commercial town or manufacturing centre speaks of abundant orders, satisfactory prices, busy workmen, and large profits? What bank is multiplying its clerks to wait on the wants of thronging borrowers? Commercial depression is the universal cry—a depression probably unprecedented in duration in the annals of trade, except under the disturbing action of prolonged war. The associations of a low rate of interest are contradicted by the stern, real facts of the actual world.

This is a subject of which it is difficult to exaggerate the importance. The diminution of trade, the slackness of production, the low range of prices, the consequent loss and suffering, are facts only too certain: it becomes of the highest moment to investigate their causes, and to discover a remedy if attainable. In any case, lessons of the highest value may be learned by studying the path by which the commercial world has reached this state: errors may be discovered, very fatal in their effects, but yet admitting, when distinctly known and understood, of being largely if not wholly avoided. To suffer without reflecting, only to relapse into the same courses under similar temptations, cannot be described as wisdom. Discount at one per cent., continuous for a long period, of itself invites the sharpest notice. The money-market is the focus of many powerful influences which tell heavily on the course which production and consumption follow. If merchants and manufacturers can miscalculate under the eagerness of speculative desires, so also may bankers and their borrowers: both groups are capable of inflicting much disorder on the country. It is most desirable to ascertain the true character of the actual situation.

In 1873 a commercial depression set in which has been growing in extent and intensity ever since. It has attacked both quantities and prices. The export and the import trade have both suffered severely. Nor is it by any means clear that the evil has reached its lowest limit. If we take the trade and navigation returns for last February, as analyzed in the city article of the *Times*, we shall meet with figures, most of which must be characterized as melancholy. There is a decrease in the value of exports of about twelve per cent., in that of imports of eight, as against February of 1876. Trade is thus contracting still—the long downward course is not yet arrested. Less wheat, to the extent of 2,500,000 cwts., was imported; the price of wheat, however, has not risen, and the inference may be accepted so far that England is becoming worse off for food. In the export figures, the writer still fails to see any cheering signs of the long-looked-for revival of trade. Both quantities and values continue to shrink in all save a few cases. Coal and coke, iron and steel, copper, cotton goods, linen goods, wool and woolen goods, all indicate that the bottom prices have not as yet been reached. "This fact, coupled with the still more important decline in quantities, compels the conclusion that the dragging trade of the last two years and a half has not as yet become more animated." This decline shows that buyers abroad of English goods are fewer and weaker. This is a fact of supreme significance for a nation whose population, and wealth, and commercial strength, are absolutely dependent, to an unexampled extent, on the exchange of her manufactured products for food, necessaries, and enjoyments of every kind. If England were cut off from all foreign trade, a large portion of her people must surely perish, as surely as did more than a million of Irish when the potato-disease left them foodless on the land. This unwelcome symptom calls for notice, wherever it tends to appear, however faintly, most of all if the suspicion occurs that foreign competitors are endeavoring to overcome us in, and to exclude us from, what are called third markets. England must sell abroad, and on a large scale too, if she is to continue to be what she is now.

Ample evidence abounds on all sides, besides the returns of the Board of Trade, to show the extent and severity of the commercial depression in England. In the foremost place stands the iron-trade, one of the great staples of the nation. After a period of overflowing prosperity, adversity has stepped in with unprecedented severity. Prices were run up to extravagant heights; coals were easily sold at rates unheard of before; new coal-mines were opened; so also were iron mines; immense industrial activity spread over large populations; laborers were eagerly sought after; unions found a splendid field for their action; strikes urged on masters—already panting to hire workmen, so abundant were the orders coming in—to concede unwarrantable wages; profit still held on successfully; and it was hard to say how wide would be the conquests of British iron. But where has the iron-trade been during the past three years? Let Cleveland answer, with her shut-up mines, her unemployed population, her depressed wages, her in many cases extinguished profits. Finished iron, steamers, rails, and other departments of iron production, are all faint with slackness. In Wales, some of the greatest iron-works of the kingdom were brought to a stand-still. The export of British iron to America has become so slack as to seem on the point of extinction altogether. The heart of business-men has become sick with disappointment over announced but never realized revivals.

Both the prosperity and the depression of the coal and iron trades have a very significant bearing on the cause and on the remedy, if any, of depressions such as that which now weighs down upon England; the one needs as much attention as the other, as will presently be shown.

Throughout the whole kingdom the blow has fallen heavily on wages. In vain have unions combined with extreme combativeness to resist the fall; natural forces were too mighty for them. Wages which were not earned by the value of the products created could not last without the ruin of the employers. The products had ceased to be demanded in the same quantities; to submit to half-time or lengthened hours, which would cheapen the goods manufactured, was inevitable under the alternative of a total cessation of work. None knew better the strength and range of the depression than the wage-receiving workmen in British factories. Even members of Parliament, selected to protect the wages of the working-classes, have come forward to press on their constituents and sympathizers the stern necessity of submitting to laws which could not be extinguished by vehement clamor and artificial doctrines.

But now let us widen our horizon, and direct our eyes to foreign lands. In these latter days the steamboat, the railway, and the electric telegraph, have created an intercommunion of nations, a binding of them up together into one

commercial whole, which very intimately connects their financial fortunes with one another. What occurs in one of these organically-associated states—for they are nothing less—produces direct and very extensive effects in every other. If one member suffers or rejoices, the others are generally, though not always absolutely, affected in the same manner. Trade knows of no nationalities, if only governments will suffer it to pursue its own course undisturbed. Have other countries bowed their heads in suffering under the commercial depression? Let America be the first to speak. In 1873 she experienced a crisis of a most formidable kind; she has not recovered from the shock at this very hour. Her people have been out of work in large numbers; immigrants have left her borders to return to the old countries. Her commercial centres, her banks, and her financiers, have poured forth loud lamentations over the bankruptcies which have assailed them and the losses they have engendered. Business has dwindled down in districts once alive with energy and hope. Collieries have been reduced to short time; so have iron-works, and some have been stopped altogether. Her railways, and still more those of Canada, speak of diminished traffic and curtailed earnings; in not a few dividends have been swept away altogether from their shareholders. If railway earnings have slain their thousands in England they have slain ten thousands in America. Her imports from foreign lands have fallen away wonderfully, without creating more employment for her protected people; there was less ability to buy any commodities of foreign origin because they bought more largely of those manufactured in their own country.

This fact, that the Americans were not diminishing their purchases of English goods merely because they bought more largely of those manufactured within their own country, bears decisive testimony that they were under the depression, that the pressure of the commercial atmosphere which weighed on England embraced America also within its sweep. It will give material help in discovering the causes of the disorder which had attacked both countries. We still find America acting mischievously on England, as England did on America; they were two provinces of one single commercial country.

Let us now return back to Europe across the ocean and visit Germany—Germany the conqueror in a great war, and the exacter of an unheard-of indemnity. What do we find in that country? Worse commercial weather at this hour than in any other. Nowhere are louder complaints uttered of the stagnation of trade. Her manufacturing industry is spoken of as paralyzed. The sharpness as well as the unexpectedness of the suffering has been humorously described in the German press under the guise of the astonishing discovery made of the commercial effects of the great indemnity. It is the gold which Germany received in such profusion which has ruined her trade and made her poor. France paid the millions, and moves with lighter step than any other nation in Europe. Let us have another war, cries the jealous writer; let us be beaten and be sentenced to pay an enormous indemnity; every finger will then point to Germany as the prosperous people. France, with her store of gold, will be in commercial despair. For a long time past Germany's impoverished traders have been raising schemes in her Parliament for the improvement of their condition. The agitation is said to have made even the imperial chancellor uneasy; if this is so, it would be impossible to have a stronger sign of how violent has been and continues to be the shock to German industry. The commotion must indeed be great when we hear that the feeling for protection is advancing with rapid strides. There are clear thinkers in Germany within and without the Governments who know perfectly what protection means; yet in spite of their intelligence and their efforts the tide of protection is on the rise in public feeling. Yet what is it that they seek to accomplish? Nothing less than to raise a charity-tax on the whole German people for the benefit of those employed in a few particular trades. Protection, under the plausible disguises of not throwing poor people out of work, and not allowing them to be trampled upon by foreign rivals, sends round a begging-cap to all buyers of goods to make charitable contributions to particular individuals. Free-traders are called hard-hearted, but what sort of a feeling is it which inflicts impositions by force of law on every consumer for the advantage of some of his neighbors? However, even in intelligent Germany, in the presence of the sufferings undergone by distressed manufacturers, the sense of justice and of the public good is giving way, and the movements of the iron-workers are troubling the Government and the Legislature. What can paint more forcibly the severity of the commercial depression?

Austria and Hungary repeat the cry, but in a somewhat lower tone; and so we come round to France, the people whose well-being has been

visited with the most violent assaults, and which has met them with the greatest of economical virtues. Her losses and sufferings have surpassed those endured by any other nation, yet the deep, heavy pressure of the commercial paralysis has weighed upon her the least oppressively of all. War has desolated her broad fields and overthrown her industries over great areas of her territory. Her taxation has been suddenly raised by the gigantic sum of thirty millions of English pounds a year—a burden ever recurring, ever oppressing her resources and devouring the fruits of her painful and persevering toil. Her share of the commercial trial has been the severest and largest of all; yet at this hour she exhibits, not the melancholy languor of business-men in other countries, but the active movements of quickened recovery, heavily clogged though they be by the failure of the silkworm and the beet-root. She will point for us presently an economical moral of the very highest value. Her recent commercial history repels the objection that the wave of financial suffering broke with less violence on her shore: the facts of her commercial situation were only too plain and too cruel. But they will enable her to teach to all nations the priceless lesson how to contend against and to overcome the calamities which reckless folly or moral visitations inflict on populations. The greatness of her disasters, and the vigor and even joyousness of her recovery, will furnish instruction incomparably more vivid and more easily gathered than the technical phrases of economical writers. In one of its most important departments France may be justly called the heroine of Political Economy.

The range of the depression receives a remarkable illustration from the report of Mr. Giffen, the head of the Statistical Department of the Board of Trade, on emigration in the year 1876. In no preceding year have fewer emigrants from England, or so many immigrants into England, been registered. The balance of emigration from the United Kingdom was only 46,575 against 225,000 in 1872. To the United States the surplus of emigrants reached only 3,473—12,060 having returned from that country back to the United Kingdom. A similar decline is shown in the emigration to Canada; while only 30,612 emigrated to Australia compared with 33,417. The significance of these figures consists in the large numbers who come back from the new lands, as affording them no better prospects than the old ones. Evidence abounds to show how little and how unremunerative employment could be found in regions which were wont to open their arms to the dense populations of Europe, and to reward them with prospects of comfort and prosperity. A situation radically changed had come over the Old World.

Such a depression, spread over so many countries, inflicting such continuous distress, and lasting for so long a period of time, the history of trade has probably never before exhibited. It is not the desolation of wide regions under the ravages of savage invaders, nor the disappearance of populations and of wealth under the long-continued and destructive violence of a Thirty Years' War. It is, with the exception of the Franco-German War, a purely economical phenomenon, the result of conduct whose nature and consequences it is the office of Political Economy to study and explain. The causes of the suffering are forces which are ever at work on the wealth of nations; the warnings and the remedy, if any, must be derived from the same source. One feature of the situation, in this very relation to economical action, comes forth with transparent prominence. Its severity, its losses, the injury it inflicts on the material welfare and happiness of mankind, are incomparably sharper and more disastrous than any ever inflicted by any so-called crisis in the money-market of any country. All the world knows what are the agonies of a Black Friday in the city. The picture has been often painted with its black and heart-rending colors. The terror of the banks, the sickening fear of immediate ruin convulsing the great firms, the wild alarm of a frightened imagination converting the possibility of insolvency into certainty, the impassioned cry for help poured out upon the deaf ears of callous bankers by companies gazing on the abyss yawning before them, the agitation of wellnigh every trader in the nation—then the stoppages, the bankruptcies, the impoverishment of unexpecting multitudes—have indelibly impressed themselves on the memory of every man of business. Struck by the powers of such terrible events, the public press for years afterward refers all uncomfortable features of trade to the agency of the monetary crisis. Its effects are traced down a long period of subsequent time. Such agonies are actual realities, and fearful indeed are the pangs they create; nevertheless this description, so far as it seeks to set forth the true nature of what is happening, is substantially untrue. A crisis, however intense, in the city, is the agony of a day of settlement. Who is to lose? is the thought which fills every commercial mind with terror. Is the

great house to be brought to suspension, which, with real but for the moment unrealizable assets, fails to receive the accommodation it always reckoned on? Or is the mighty bank, with its hosts of depositors, to break, because they are rushing in mad fright to claim the return of their balances in gold, or because it has unwarily trusted speculative companies, which cannot repay the advances they received? No one knows how far he is safe, how far the foundation on which his business has all along proceeded may not now be giving way. But there are two most essential points to grasp in the understanding of these sufferings. These events are effects of causes which have preceded them, and in those causes, and not in those effects, lies their significance for the national wealth; and, secondly, they are occurrences in the region of ownership and financial machinery, and not in the region of the wealth itself. They are settlements of losses, determinations of future commercial positions, discoveries of what firms are to disappear, and what other mercantile houses are to succeed them in the future. But the real question for the country is, What has happened, or is happening, to its wealth, its industry, its power of producing? It is easy to conceive in imagination commotions as agitating as those of a Black Friday, and yet which would have little effect on the prosperity of the country. A multitude of land-owners might gamble with their estates as stakes with a machinery which would not disclose their position till a deferred period. On the day of settlement the agony might be intense, the terror of many great, boundless ruin overwhelming others, and winners established in colossal fortunes; yet the national wealth would be undisturbed; owners of property would be changed, and that would be all. Quite other would be the result if the gambling had led to selling the seed-corn abroad, to buying costly wines, or to the exporting of the cart-horses for luxuries, or to the neglect to repair tools necessary for winning the next harvest, or to other similar acts. In such cases the wealth of the country, and the well-being of its inhabitants, would be attacked at the core; the public loss would be most real, and its reparation long deferred.

Of the latter character is the commercial depression of which we write. A so-called monetary crisis, of itself alone, tells us nothing as to the range of its disorders, and their action on the national prosperity. If they are the consequences of pure gambling, what one man or firm loses another wins. In other respects there is no change. But it is true that these crises do presuppose some destruction of wealth: and so far they are of national importance: but it is this destruction, and not the city disturbances, which is the power at work. And here it is that the present depression indicates an amount of disaster, paralysis, and injury to the public wealth, with which no city convulsion can compare. If three banks out of four in the city, or as many mercantile houses, were to fail, the injury would be slight by the side of the effects of these years of suffering, so far as these failures were not the direct consequences of wealth distinctly destroyed and unreproduced. The urgent need, the extreme importance, of investigating to the bottom the character and causes of the disorder from which so many nations have been now suffering for so long a period, becomes abundantly clear.

We are thus brought to the root of the question. What, then, is that cause? Why is it that, for some three years or more, so many countries are suffering under stagnation of trade, are complaining of reduction in business, are buying less and selling less, have only diminished profits to reckon up, are abounding with laborers out of employment, have steadily distributed ever scantier wages to their people, are reducing their comforts and enjoyments, are sending back emigrant laborers to their old homes from lack of employment, even amid new lands and fertile, uncultivated fields? The explanation will certainly not be found in gold or in its movements from one vault to another, nor in pieces of paper, by whatever name they may be called, nor in any form of currency whatever. One per cent. has nothing to do with gold, nor has any one said anything so ridiculous. Nations are not made poor, nor their business stagnant, nor their mines and their factories shut up, nor their people thrown out of employment, because the tools of buying and selling are in one place rather than in another. Such bright ideas may crowd in upon the minds of a frightened city when seven per cent. threatens to become ten; but all talk about the reserve, and the circulation, and bank-notes, has sunk under one. Such a rate throws them at once upon the realities of commercial life, upon the state of industry, upon the substances to be bought and sold, not upon the machinery of exchanging. The cause lies elsewhere, it is not to be found in exceptional circumstances of an uncommon kind. No series of bad harvests has destroyed the population. No innovations in legislation, no change in our laws or in tariffs, had disturbed the habits and the confidence of

traders. No Napoleon had poured forth Berlin Decrees, or pounced on the goods of a great commercial people wherever he could find them, or cut off from large populations their supplies of articles of the highest importance, or isolated mankind into untrading groups. The cause is simpler and deeper than any of these.

That cause is one, and one only: over-spending, over-consuming, destroying more wealth than is reproduced, and its necessary consequence, poverty. This is the real *fons mali*, the root of all the disorder and the suffering, the creator of the inevitable sequence of cause and effect. Men have acted as a man who farmed his own land, and had consumed not only the portion of the crops which were his true income, and were a surplus remaining over after he had fully provided for all the agricultural operations of the next year, but had, himself and his dependents, devoured a portion of the seed-corn and of the breeding-stock, had exchanged a portion of the produce which was required for wages in the coming year for foreign luxuries, or had consumed these necessary reserves on an excess of drainage, however valuable in itself and ultimately enriching. Every one perceives the necessary consequences of such conduct in individual life; but when the general condition of a whole people is spoken of, the complications are so many and so great, the simple, universal process is so sunk under a multitude of intricacies, that few retain their hold on the ultimate elements which underlie all conduct, whether of a single individual or of a complex population. But a nation is only an aggregate of individuals. Whether cloth is made by a weaver or by the agency of a machinery which fills large factories, and employs the most diverse and the most numerous agents, the methods always remain the same in principle.

If we bear this governing truth in mind, that analysis will always resolve the action of the single man, and the combined coöperation of a host of workmen under employers, managers, clerks, foremen, merchants, and others, into the same constituent parts, we shall be able to arrive at a clear understanding of one per cent. The first offender against the law that to consume more than one makes must land man or nation in difficulties and impoverishment, was America. She constructed an enormous length of railways, which she carried out into the wilderness. In no country, ever before or since, has such a rush into railway-making been ever witnessed. Nor did the passion fall on railways only; docks and canals, elevators and warehouses, wharves and gigantic stores, were impelled forward by the same whirlwind. Under these impulses she consumed a vast quantity of food and clothing for laborers. She destroyed coals and machinery in making iron. She fed and rewarded with the contents of her shops and stores a large army of promoters, engineers, managers, book-keepers, brokers, bankers, and other functionaries of every kind. What had she at the end of the operation? Long lines of iron carried over a vast extent of country, holes made in the ground and called tunnels, embankments, and buildings. What all these laborers and functionaries had eaten, drunken, worn, or used up as materials, was gone forever: the rails that replaced this consumption could bring no means of living till after they were in operation for a long period. The nation was plunged into poverty to the extent of what the railways had devoured in constructing. In the wilderness there was no traffic: and even if the lines had been made in a popu lous district, many years must have elapsed before the shops, warehouses, and factories, could contain the same identical wealth as the rails had destroyed.

But railways enrich: quite true, but so does drainage. If a man spent all his income in draining, what would become of him and his family? They must starve, unless supported by the loans or charity of others. So with the railways. If what had been consumed in constructing them had been applied to restore the food, clothing, and other things used up by their makers, no one would have been poorer, no one would have had to betake himself to short commons. America acted as the landlord who spent more than he could afford in draining; there was a far smaller quantity of other wealth in the country to support life and to carry on business; there were long lines of rails, and poverty.

But railways are constantly made without inflicting any injury on trade or on the public wealth: where, then, is the limit where their construction becomes mischievous, and brings down suffering on a people? This is the very kernel of the question. The explanation is very simple and very obvious; but it is most difficult to be remembered as a practical truth to govern conduct. Up to the extent of the savings of the nation, expenditure on railways can do no economical or financial harm; and these invaluable developers of wealth may on such a basis be rationally acquired for the public good. Any outlay made out of savings, be it what it may, is

innocent of mischief; it may do no good, but it does not impoverish. But what are savings? The surplus of wealth made over wealth consumed. If it is turned into capital and applied to increased production, the nation becomes richer; if it is expended on any luxury or any folly, the nation is where it was. But if the outlay, however wise and ultimately profitable, once passes the limits of saving, harm instantly begins. There arises a loss of wealth which is taken from capital; the means of producing are diminished; fewer goods are made. There is less for merchants, with their ships and their railway-wagons, to exchange; there is less to divide among the people, poverty has actually set in, and it may easily advance to stagnation and distress. A rich man with £50,000 a year may spend £10,000 on fox-hounds, or game-keepers, or race-horses, or on servants, without lessening the national wealth; but, if he applies £100,000 to the improvement of his estate, with the certainty of great benefit to the whole neighborhood later, if he cannot borrow, he inevitably falls into trouble and real poverty. What such a man might do, America has done with railway-making; and she has not recovered from the consequent prostration to this hour. The departing emigrants, the depressed wages, the lowered profits, the smaller trains, all proclaim that there is less wealth in the country, less to divide among its inhabitants.

That particular kind of over-consumption of wealth which consists in excessive investments in fixed capital generates effects which greatly aggravate the commercial disorder and the subsequent distress. The construction of railways or docks beyond what the savings of the country can afford creates consequences of an infinitely wider range and deeper mischief than would result from a loan to a foreign country of the same amount as the cost of these works. A nation living beyond its means, even when a useful end, and not mere enjoyment, is the object, exhibits many of the qualities of the spendthrift. It bubbles up with excitement. The large number of orders given for coals and iron raises prices, sends up wages, and enlarges profits. Imaginative estimates are spread of the expanding prosperity of these trades, as well as of the many others which are associated with them. Iron-mines are opened at heavier expense than what the actual demand for coal and iron justifies, thus increasing the destruction of capital. The retail, the shipping, and other trades, feel the stimulus; buildings are raised, steamers and shops are constructed, costly establishments are formed, each in its turn setting other business in motion. Every one prospers, and every one makes arrangements, at further expense of capital, for still greater prosperity. Thus, new railways, costing ten millions, generate an excitement which may easily raise the outlay to twenty. So stimulating are high prices and high profits, so creative of more factories and workshops to swell them further. The collapse becomes all the severer—with the special disaster that this increase of outlay is a pure waste, a child of wild hopes.

Nor does the mischief stop even here. Along with these cheery feelings and high prices, personal consumption rapidly expands. Employers and workmen alike indulge in more expensive living, and this impulse, acting on numbers, swells the waste to a still more formidable amount.

What occurred in America occurred elsewhere. We now pass on to Germany. Here we find the circumstances different, but the substance of the facts the same. Germany became engaged in a gigantic war with France. In these modern days, the cost of armies and of their armaments is enormous, far exceeding that of preceding ages. Immense numbers of troops took the field, and their maintenance alone created a vast consumption of wealth, without any return for it in the shape of fresh wealth. Men were carried from their labor in the fields and factories in huge hosts, paralyzing domestic industry, and devouring the existing stock of the national wealth. No more rapidly impoverishing process can be conceived than such a war. That commercial distress should follow such destruction can create no surprise. Suffering and impoverishment are the natural offspring of war. But did not the indemnity make all right for Germany? Two hundred and twenty millions of English pounds might seem enough to lift any people to the summit of prosperity. But it is not sums of money which enrich and bestow welfare and happiness, but what is done with them. A large portion of this money was applied to the making of fortifications and to other military works. No improvement of their condition, no relief to their distress, was got out of that by the nation. On the contrary, such an application of the French gold made matters distinctly worse for Germany. German labor, and German food and clothing, were taken away from that production of wealth which would have brought better times, and were applied to the piling up of military stores in a very unproductive way.

But gold is riches, and riches supply every kind of necessaries and of comforts. Gold, we answer, is not riches till it is made use of by being parted with; that is all the good which can be obtained from it, unless it is applied in the arts to gold ornaments. Gold exchanges commodities —enables a manufacturer to procure coals in return for his cloth. But the gold itself, and by itself, confers no other benefit whatever than its services as a tool. Germany would have been most truly and permanently the richer for the French gold had she given it away to foreign countries in the purchase of their wealth; it would have brought what her people wanted into the country. But Germany could get no gain by obtaining gold solely to move German things about.

Then it is believed that a considerable portion of this French gold has been hoarded as a reserve against future war. That gold does nothing to clear away the commercial depression; it sets no mills to work, gives employment to no laborers, imports no supplies of corn, meat, coffee, and clothing for the people, or raw materials for their industry; it is idle, and absolutely no better than if it were non-existent.

But there is another portion of this French gold, of which there is yet worse to tell. Its action is full of instruction, especially for the city, if the city were only willing to gather it up. The German Governments were embarrassed with the excess of this metallic stock, and lent much of it to traders and speculators. To what better purpose could they have applied it? it will be asked. To none, but upon one condition—that it should be sent out of Germany. Its export would have placed in Germany useful things, in the place of useless tools for exchanging, of which there were already enough. But, by being retained in Germany, and lent to borrowers, it not only was unproductive of all good, but was really engendering mischief peculiarly its own. The borrowers took to buying German goods; prices rose in the shops and warehouses all over the country; profits were realized, and wages gained advances; and then the evil consequences soon appeared upon the scene. An increase of spending broke out all round; there was money in hand; it was applied to buying things pleasant and enjoyable. A higher style of living was adopted; in other words, a larger and more rapid consumption of wealth prevailed. And what was obtained in exchange? The gold, which did not restore the wealth consumed, but only transferred existing things from one set of hands to another. Did not the humorist stand on the ground of solid sense when he exclaimed, "Let us have another war, and let the Germans have to pay the indemnity?" Had he not the acuteness to perceive that, if much harm is to be averted, the sooner an excess of gold is sent out of the country the better? Let those who bewail exports of gold, and record its imports with delight, ponder over his words and the facts that elicited them.

If, now, we turn our eyes to France, how different and how startling is the picture which presents itself to our gaze! Here we were bound to expect the sight of acute suffering, financial depression, stagnation of trade, poverty, and misery. The war had been infinitely more oppressive to France than to Germany, for it had been waged within her territory. She had lost two valuable provinces and their resources at its termination. A fine of unheard-of magnitude had been imposed and paid. Thirty additional millions of taxation had been added to a budget already severe. Much of the fixed capital of the nation, of its factories and machinery, had been destroyed or injured by the war. Where could ruin and depression be more naturally looked for? Yet what a spectacle does France offer to the observer! The piled-up load of taxation is borne with ease. Her industry is in full play. No sense of poverty weighs down the people. Her army is undergoing a thorough and successful transformation; guns and military stores—what they cost in these days is known to all—are swiftly being accumulated. Great has been the astonishment at Berlin. Eighteen months ago a violent scare sprang up in that town; the conqueror fell into vehement fear of the conquered. Germany awoke from her dream of security. The great military chiefs loudly called for a second war to break up an enemy whom neither defeat nor chastisement could crush. To what was this most unlooked-for and most astounding sight due? To the practice of one of the very greatest of economical virtues. She had saved. Her eight millions of peasant-proprietors had lifted their country out of the depths of adversity by invigorated energy and reduced consumption. If more had to be paid to the tax-gatherer, the peasant gave up meat or other indulgences rather than diminish his means of maintaining his farm or his vineyard at its former level of efficiency. No doubt France obtained very valuable aid from the inveterate hoarding of her people. Then it was that stores of gold could do vital service. They had lain buried in hidden stockings, useless

and unproductive; but the German asked for gold, and here was gold ready to be given to him without any injury to the paying nation. The peasant lent his gold to his government, who passed it on to Germany; he was compensated with an annuity derived from an augmented national debt; and that interest, that annuity, he helped his country to pay by the sacrifice of more time and labor on his work, and the giving up of many of his small comforts. These are the realities of political economy—and what fruit do they not bear?

If, now, we cross over to England, we still find that the same general causes have been at work, producing similar results, but their mode of action has been somewhat different. England has not, in the period we speak of, broken out into an excessive construction of railways, nor has she experienced a war, much less had to pay a great indemnity. The depression she now suffers succeeded a period of exceptional and excited prosperity. The Americans had bought largely her iron for their railways; the Franco-German War stopped much of the manufacturing trade of both countries; England filled up the gap, and supplied materials which previously had drawn many of their resources from the now warring states. Business flourished with unprecedented success, prices rose to a great height, large profits were earned, and then the time for mischief set in. New works were constructed, new coal-mines opened, factories reared their heads on every side; Cleveland was busy in sinking shafts—in other words, an undue quantity of wealth was consumed in carrying on works which were to repay their cost in a distant future. Savings were exceeded; impoverishment was the inevitable result. The high profits and the raised wages led to more expensive living; unproductive competition was enlarged; men thought that a new era had dawned for a vast increase of the coal and iron industries of the nation, and all rejoiced together in augmented consumption of the stock of wealth. Presently, the exceptional causes of the excitement ceased; the action of peace drew back the unusual orders for English goods; prices fell, and the half-finished works only attested the waste they had created. The point to grasp is not that England had had a good time of selling, while competitors were idle, and other nations were spending, not their income or savings, but their capital, in the purchase of her goods; and then the irregular prosperity had ceased. The commercial depression, so long, so monotonous, so heavy, and so dull, came from the excessive consumption of English capital in unwarranted constructions beyond savings, and unwarranted expenditure in living by all classes, which destroyed wealth without repairing it with new productions. English saving, unlike the French, has not yet replaced the loss. The whole of the capital of a nation might easily be eaten up and consumed in pleasant things even in three years; how long would be the depression that would follow? If a farmer spent the whole of his crops in buying fresh horses and agricultural machines, in raising new barns and putting in fresh drains, where would he and his people be in the succeeding year? A mere return to ordinary prices and profits from the cessation of exceptional activity would not generate a depression of any importance; it is what is done during the prosperity that breeds the evil to come and to last.

The influx of unusual orders for the products of English industry developed a cause of impoverishment which grew to formidable proportions. Ideas founded on a profound ignorance of the nature of all trade and industry had long fermented in the minds of large numbers of the working-classes, and they took advantage of the unwonted and urgent demand for labor to enforce demands which have ultimately led to very heavy disaster. That when trade is abnormally brisk, and much work is going on at highly-remunerative prices, the laborers should ask for and obtain an important increase of wages, is not only reasonable and fitting, but, by raising their condition, is a real gain for the whole community; and if even they stand out for and secure more than their fair share of the products of labor, the harm is of small moment; they are sellers in an open market, and the turn went in their favor. But the situation becomes radically changed when, on the return to ordinary sales and prices, the laborers refuse to adapt themselves to altered circumstances, and insist, by most mischievous methods, that the exceptional wages shall be permanent. They then shut their eyes to the fact that their real position is that of sellers of a commodity in a market, and that, if its value is substantially and permanently altered, the law of supply and demand will assert its supremacy ultimately, whatever be their efforts to repel its rule. If they persevere to the bitter end, production must cease, and their labor with its reward must disappear. Meanwhile the process of resistance entails sufferings on the whole people which may be incalculable. Our point here is, not the harm which perverse and ignorant action may bring on the laborers themselves—we speak from the point

of view of the wealth and the welfare of the whole nation. Strikes convert the workmen into wasteful consumers of wealth: the food and clothing they destroy becomes a dead loss, without compensation; the closed works deteriorate in condition; it may take months and an immense outlay to restore them to an efficient state—again an unmitigated destruction of wealth. The calamity spreads on to auxiliary trades, to the makers of machinery and materials—again consumption without production, a clear diminution of the public wealth. Thus the impoverishing process does its fatal work: it eats up capital, it lessens the power of making and of employing makers; the means of buying dwindle down, for to buy is only to exchange wealth for wealth, and with less wealth there must be less buying, less business, stagnation and depression in every direction; and if the strikes are wanton, against permanently lower prices, as experience has amply demonstrated for many months past, are we not in presence of one cause of the commercial depression?

But there is worse yet to tell. Strikes are instruments of war: and, the battle over, the loss may be soon effaced by the energies of peace. But the novel principles on which trades-unions construct the regulation of labor are a very different matter indeed. They generate conduct which inflicts injury of the widest range, and, still more, creates influences whose misleading power is very enduring. The unions lay down rules which attack the quantity and the quality of the article they have to sell. They thus attack the efficiency of labor, the worth of wages, to the injury of every man in the country. To limit, by arbitrary regulations which take no heed of the position of trade and industry, the quantity of labor sold for a given wage, to undermine its quality by demanding the same reward for the man who works badly as for the man who works well, to give no play to the differences of physical and mental ability with which Nature has endowed human beings, to suppress the energy of character and of hope by the abolition of piecework and of the strongest motives for exertion, to demand of a purchaser a fixed and elevated price without the slightest regard for the quality of the article sold, to encourage laziness, unmanliness, the absence of the respect for the man's self as well as for his employer, and to place the relation of seller and purchaser on the basis of inherent and abiding hostility, is to violate the laws of human nature, as it finds itself in this world, and to trample under foot the fundamental principle of every form of industry, that work should be as productive as possible, and the wealth thereby produced should reach the highest range of abundance and cheapness. It is not to know the vital truth that the laborers and the capitalists receive their satisfactions out of one common fund, the wealth created, and that what renders it needlessly and artificially smaller is to injure both the parties who contribute to its creation, and along with them the whole people.

The unions have failed in their vehement resistance against the law of supply and demand which governs every market, that of labor as well as any other They had to choose between refusing to give the article; that is, between no wages or a lower price for labor; but great was the harm they did to the public wealth during the struggle. Prices were kept up for a long time above their true level, fewer goods were produced and fewer sold. Foreign countries, especially after their excessive creation of machinery for producing had ceased, had become extremely bad customers of England. Still worse—they undersold the dear goods of England in distant markets. In many instances they actually invaded England herself: Belgian and American goods were freely sold in the heart of the very workshop of the whole world. England was doing less business and becoming poorer.

There is one fact more of great significance, which must not be omitted in this review of our late commercial history. Men of the mood of mind of the unionist workmen are emphatically not savers. When wages are large, they do not, like the French peasant, turn a portion of them into saving, and thereby increase capital, and the production of wealth in the country. What they extort from employers they consume unproductively; they destroy it in indulgences, and only too often in drink. This engenders a very marked distinction between exceptional wages and exceptional profits The marked tendency of employers is to make themselves rich, to build up fortunes; but, really, fortune means a machine for the constant production of wealth. That is its very essence. To buy an estate—the common ambition of the prosperous English trader—is to acquire a rent-yielding instrument: and rent is the result of the cultivation of the land. A heavy holding in railway-stocks is the ownership of an instrument which enriches not the shareholder only but the whole country, which calls into being a vast power of employing and rewarding labor. The mighty towns of England, the countless factories of her manufacturing regions, are all savings out of profits: how feeble are the pro-

ductive instruments to which wages can point as the fruit of the laborers' thrift! It cannot be doubted that an enormous amount of waste of wealth, of unproductive consumption, often of the worst kind, has been the result of the augmented wages of the working-classes. High wages, if justified by the value of the work given for them, are what every man in the country should rejoice over, and wages so earned are an excellent basis to establish a tendency to apply a portion of them to capital and saving. But high wages, exacted by strife, and accompanied by little and inferior work, evoke a spirit most hostile not only to saving, but also to a rise of the laborers in civilization, in an improved moral and social condition. They gravitate to gross, wasteful, impoverishing consumption.

There remains, lastly, to notice one more powerful begetter of impoverishment—loans granted to foreign countries. For a period now extending beyond ten years they have been given away with a profusion truly astonishing. The terrible disasters of the crisis of 1825, and the lessons which it taught, had been forgotten. The desire to lend to the multitudinous states of South America had revived, and had swollen almost into a passion. Peru and Venezuela, Honduras and Guatemala, Turkey and Egypt, had swallowed up many millions' worth of English wealth; and what has been the return? The generous operation has been constantly repeated to the British colonies, to Australia and New Zealand; but with this difference, however, in comparison with the self-civilized countries just enumerated. The proceeds of these loans were invested by the colonists in railways, in developing the emigration of laborers, in the providing of clothing and other necessaries for their maintenance—in a word, in the production of wealth or capital. England lost, for the time, what she lent; but she gained additional fields, more numerous flocks, greatly-enlarged supplies of wool, all as directly enriching her as if the colonies had been so many additional English counties. Thus she obtains not only the interest on these loans, which is always duly remitted, but also a mass of goods which she requires for her factories, or her food. Trade is generated as if between two English provinces; exchanges of wealth proceed expansively. The mills of England are more active, and her warehouses more full, precisely because her loans are capital at work to produce wealth for her service. The difference between such loans, and iron-clads and palace-money lent to Turkey, is vast indeed.

Nevertheless, the depressing force for the time, if the loans have ranged beyond the amount of England's saving, produces its inevitable effects. The same tale has ever to be repeated: it is the squire of £50,000 a year spending £100,000 in draining. The creation of fixed capital, the construction of machinery for producing wealth, which repay their cost only after long years, is as sure a creator of poverty for the time, if not made out of savings, as if they had been raised up for amusement and then thrown into the sea. And it is very desirable, in this connection, to understand the process of granting loans. They are levied in the city apparently in money; they are described in pounds; they are never spoken of but as money; yet money is wholly absent from them. Loans are not, and cannot be, lent in money by England—for the very simple but very decisive reason that she does not grow gold and silver in her fields or factories. If some trifling portion of such grants crosses the water in coin or ingots, those ingots have been purchased with English goods. And it is those goods which eventually are the only things which England can send away. And, in actual fact, most loans are directly and at once remitted in goods. The Australian colonist who commands the credit granted in London by the loan he has obtained, at once purchases supplies of clothing, machinery, iron, and other products of an old country, and transports them across the ocean. It is absolutely certain, in ultimate analysis, that no country can lend anything else but what she has. Australia and California can lend gold; it is the natural produce of their lands, as iron-ore is of England's; but the city would be under an entire delusion if it imagined that the gigantic receipts which swell the account at the bank of the lucky borrowers were money about to cross the water in ingots. The city possesses machinery of exchange — notes, checks, clearing-houses, bills, paper of all kinds; but the realities are not in them, they are to be found only in the goods which the machinery moves.

A full understanding of this fact will enable us to perceive clearly how loans directly attack English wealth, English goods, and diminish them. When they take their departure there is less left at home to use and enjoy, less merchandise to do business in, lighter weights for railways to carry, and—which is the important matter—less wealth to buy with, less to give to the shops and warehouses to procure the articles which they contain.

We now reach the question, What has the rate of discount in the city to do with this state

of affairs in the nation? what is the connection between one per cent. and the commercial depression?

The impoverishment we have described would seem at the first blush to lead us to expect a high and not a low rate of interest on loans. A diminution of the capital of a country, by consumption carried out beyond income and savings, would naturally, one would think, create a loud demand for capital. Capital has been destroyed, and capital is the one vital instrument for the production, in this case for the recovery, of wealth. A rush for the loan of capital might have been looked for. The bankers and merchants of the city are fond of speaking of loanable capital, as being actually in their hands: how comes it to pass that their doors are not thronged with applicants for advances? Why do they find it so difficult to employ the means at their disposal with a profit to themselves? In the colonies and other new countries, the very opposite phenomenon presents itself to the eye. There capital is scarce, and so are laborers; and there is pressing demand for them: and the rate of interest is very high, and workmen earn immense wages; and the cry is ever for the loan of more capital, to be paid for handsomely, and with perfect ease to the borrowers. Why is it not so in England at this hour, when so many of the circumstances seem to be the same? Because, in a colony, the capital and the laborers are applied to the uncultivated fields, and raise new crops of corn and multiplied fleeces of wool, which yield brilliant profits and wages, from the largeness of the return compared with the expenses of the tillage. The machinery for producing is deficient: if it is supplied, the land forthwith raises up wealth, which enriches all. The depression of trade, on the contrary, in England, means not a deficiency but an excess of the machinery of production: and that constitutes the essential difference between the two states. The vocation of English industry is to produce articles needed over the whole globe: she manufactures them in order to be exchanged for the products of other countries; she makes them in order to be sold. But buyers have fallen off in number and ability to purchase. Her goods are in feebler demand, but her producing power, her fixed capital, her machinery, remain unchanged. Here is the very pinch of the matter. She is compelled to shut up many of her factories, to dismiss or put on half-time immense numbers of her working-people, because there are fewer buyers of the articles they manufacture. Americans, Germans, the colonies, Turkey, Egypt, South Americans, have reduced means for buying: their orders are scarcer in the English markets: stocks of iron and other goods accumulate: but there are no buyers. "There is, therefore, nothing for it," we read from Middlesborough as we write, "but to reduce the make of iron." In a colony the desire is to make more corn and more wool—hence capital is in demand, additional capital to be imported from another country. Applied to the fields, it produces wealth which is needed, and the rate of interest accordingly is seven per cent. or more. In Cleveland less iron is demanded, and the furnaces are in excess: some must go out of blast. Thus there is seven per cent. in New Zealand, and one per cent. in London. No bills upon iron sold are crowding up for discount to the city; no merchants are seeking advances upon steamers laden with rails for America, Russia, and Australia.

A second important distinction must be drawn between the borrowing of capital by a colony and by application for discount to the banking community of England. It merits attention, as revealing the nature of banking deposits. What a colony seeks and obtains is an actual importation of positive wealth and substances into its territory. Its loans, as has been already explained, are taken out in goods. There is a clear accession of additional wealth to the colony. Not so in the money-market of England. No new capital is obtained for the nation by discounting at a bank. Loanable capital does not exist in any bank, or in any money-market: it is not to be found there. It may be reached through the agency of a bank; but the bank has not got it in its own possession. The resources of banks are debts due to them by holders of property: nothing else. To discount a bill is virtually to order a debt to be paid: and the effect of that order is to transfer property—capital—from the hands of the previous debtor to the hands of a new one. That is the real nature, the true fact, of discount. No additional help of capital is given to England by banks: it is only placed in different hands. The question, then, under the present commercial distress, becomes, Are there traders who desire to tempt a banker, by the offer of a higher rate of interest, to withdraw capital from his debtors and to transfer it over to them? The answer now is, that there are few or no such traders. Businesses are not competing for the capital possessed by banking debtors: and one

per cent. is all that the poor banker can obtain.

And now the question will assuredly be asked, How much longer is one per cent. to last? Probably for some time longer. At this present moment there is a flutter upward, but it seems to arise from an accidental and temporary cause. The Government is a borrower, and so large a customer has a certain effect for a time. But this is not a permanent force: as the revenue flows in, the borrowing will cease, and the substantial rate of the nation will assert its supremacy. Poverty is mended only by saving; and saving, except under very exceptional circumstances, is a slow process. A nation like England, whose customers cover the whole world, is bound up with the fortunes of countries of the most diverse commercial conditions. That the construction of railways will be revived, and will be pushed on with the wonted vigor, is indubitable; it is a necessity of civilization; but when will the work recommence? That no one is scarcely able to predict. And if the United States renews her railway-labors, will she buy her iron of herself or of England? That is a question which experience alone will be able to answer. So also of other commodities, and of other countries. Will they draw their supplies from England or from elsewhere? For our part, we believe in England, in her manly intelligence, her indomitable industry, her resolution and courage under difficulties, her long experience, her vast resources of capital, and, not least, in her perfect faith in free-trade. But she and her customers have lived beyond their means: and they must submit to the discomforts of convalescence.

—*The Contemporary Review.*

GIOTTO'S GOSPEL OF LABOR.[1]

By SIDNEY COLVIN.

I AM going to ask you to study with me a series of old sculptures in Florence.[1] The series consists of twenty-six subjects carved in relief round the base of the great bell-tower of the city. They were begun almost four hundred and fifty years ago, and their workmanship is very simple; at first sight, perhaps, you will think it very rough. But I hope to show you what power and purpose there is in that simplicity, and how completely, in these few manful strokes of the old Tuscan chisel, the genius of a great people is expressed.

When I say that these sculptures express the whole genius of a people, I only say what is true, in a greater or less degree, of every work of art. Every work of art contains the record, if we know how to read it, not only of the skill and fancy of the workman who produced it, but of the thoughts and the civilization of those among whom he lived. It is because of this concentrated human and historical significance which belongs to them that the study of the works of art is so especially fruitful. You are all familiar with the division of educational studies into two great classes, the class of real or Nature studies, which make up what is called a scientific education, and the class of literary or humane studies, which make up what is called a classical education. Between the partisans of science and the partisans of literature there has at times been hot debate, each claiming preëminent if not exclusive excellence for their own range of studies. The study of the works of fine art has found, by comparison, little place in our discussion of educational systems. Nevertheless, it constitutes, in a manner, a third order of studies lying half-way between the other two and combining some of the characteristic excellences of both. For the study of the works of fine art is akin to the physical sciences on the one hand, in that it is a study not of words but of objects, and investigates the properties of things that can be seen and handled; and it is akin to literature and the classics on the other hand, in that, in objects, the properties it discriminates are properties

[1] The two lectures of which the substance is here abridged were illustrated for a popular audience, by help of the oxy-hydrogen light, with slides reduced from a set of photographs taken at the instance of Mr. Ruskin in 1874, and published by Mr. Goodban, of Florence. To Mr. Ruskin I feel that I owe not only thanks for the materials I have thus been enabled to use, but also apologies for attempting to work out a subject upon portions of which his genius has already set its mark.—S. C.

which have been impressed by the agency not of Nature but of man. It is a study of the utterance, in things which can be seen and handled, of the thoughts, the imagination, and the sentiments of our fellow-creatures. Just as a geologist will take up a mineral, and read in its substance and structure the history of a thousand cosmic forces—histories of frost, of fire, of drifting down the channel of some vanished glacier, or rolling in the waves of some ocean that has ceased to flow—so we may take up the first fragment of carving or painting, and read in its lineaments a record more moving yet, for the forces that have moulded or tinted it are the forces of the unsearchable spirit—the furnace at which it has been forged is the furnace of the heart of man. And as I suppose the fairest agate is not always that about which geology finds most to tell, so it is not always the most finished work of the mature periods of art that contains the most of imaginative, of human, of civic interest. Among the beautiful and accomplished products of mature Italian art in the sixteenth century, I know of none which expresses the collective mind and history of a community as pregnantly as these simple carvings, at the beginning of the fourteenth, expressed the mind and history of Florence.

I.

The previous century, the thirteenth, had witnessed two great revolutions in Italy. The first of these was a spiritual and religious revolution, the second a social and political revolution. By the spiritual revolution, all the laboring and suffering populations in Europe, and most of all in Italy, had been brought into hearty and loyal allegiance to the Church at a moment when they had seemed most to threaten disaffection. Schism and heresy had been rife in every town and in many remote districts of the country, when the influence of two men went suddenly abroad, and recalled to the fold the flocks that were about to wander. These two great and efficacious missionaries were St. Dominic and St. Francis of Assisi. In Italy it was above all the passionate, practical humanity of St. Francis that won the hearts of the people, and filled all men with a new enthusiasm for the faith of which he was the inspired preacher. Hence it came about that the life of the Italian people, in the age following the ministrations of St. Francis, was a life of convinced and solemn piety in all private thoughts and public acts—that it was an age of fervent and renovated Christian devotion. This Catholic revival, this religious revolution, was completed before the middle of the century. The political and social revolution in Italy effected itself afterward, between 1250 and 1300. It consisted in the emancipation of the cities from feudal government, the assertion of their republican independence, and the organization of their civic authority in the hands of the trading and industrial classes. In both these great movements Florence was foremost. Florence was the most pious of Italian cities; Florence was the most free and democratic. She won her liberties, and settled—so far as she ever really settled—her government after many struggles, and at the cost of much bloodshed and much anarchy. But no bloodshed and no anarchy availed to abate the love of every Florentine for Florence, the pride of every citizen in his city. The sense of great destinies was upon the people; there was a greatness—so, with a grave consciousness, says a chronicler of the time—in their thoughts, their enterprises, their words, their bearing.

Of all enterprises into which an Italian people could throw its heart, the raising of great public monuments to the honor at once of their city and their God was the enterprise into which they threw it with most unanimity. It was at the close of the thirteenth century that the people of Florence determined to make the church of Sta. Reparata, the mother-church of their city, worthy of their new greatness. The work was begun by Arnolfo, in the style of building which is peculiar to Tuscany in this age. Two centuries before there had been a great outbreak of building activity in Tuscany. The builders worked in that style which is called Romanesque, having been developed in the early middle age from the Roman style proper. Its main characteristics are a love of clear, well-lighted internal spaces without complication or mystery, the use of the round of arch, of roofs nearly flat, and the horizontal division of height by strong bands and cornices. For external enrichment, this style employed one of two different systems, or sometimes a mixture of the two, viz., the system of inlay or incrustation, with white, black, and colored marbles, and the system of arcading with horizontal tiers, one above another, of little columns and arches in projection. This mode of building prevailed in Italy for a long while after the Gothic, the pointed style, had spread from France to all the countries north of the Alps. Presently, the taste for the pointed style

was brought across the Alps to Italy, chiefly, it seems, by the influence of the Dominican and Franciscan brothers. But the Italians never really adopted the principles of the Northern architecture. They did but adapt the Gothic patterns and Gothic piercings to the decoration of buildings raised according to their traditional principles. In this mixed manner they produced, for a period of about a hundred and fifty years, monuments of surpassing beauty, richness, and delicacy. In this manner Arnolfo designed the great church of Florence, called no longer in popular speech the church of Sta. Reparata, but the church of the Virgin of Florence, our Lady of the Flower, or of the Lily. Some time after the death of Arnolfo, in 1334, the famous painter Giotto was summoned to continue and complete his work. At this time Giotto was nearly sixty years old. He had spent his life traveling from one city of Italy to another, and wherever he went had won fame and friendship. He was a painter far greater than any that had gone before, and greater than any who came after him for many years. But we do not hear of his having been employed, till now, on sculpture or architecture. However, he must have thrown all his energy and all his genius into the work. He died within two years of his appointment; but in the mean time he had designed not only a rich, new front for the cathedral, but a new bell-tower, down, as we are told, to the last detail of its decorations, which was to stand at the southwest angle of the church. This bell-tower is the famous Campanile, the most beautiful of all buildings in the inlaid and incrusted Tuscan-Gothic, and one of the most beautiful, certainly, in the world.

It is interesting to notice, in some of Giotto's early paintings, the designs of architecture which he puts into his backgrounds. He was engaged, almost as a boy, in helping to paint a great series of frescoes, in which the miracles of St. Francis are commemorated in his native town of Assisi. In these he had occasion to paint plenty of tabernacles and pavilions designed in the new Tuscan-Gothic manner. And now in his old age the occasion comes for him to raise in actual marble a building fairer than any of those dreams of his boyhood. We all dream dreams, I suppose, and make up in our imaginations things we should like to do in reality. But it is only the very lucky who ever live to see their dreams come true. Generally our imagination is but the safety-valve of our discontent, the means by which we make up to ourselves for the disappointments of fact. The weakness of our powers, or the constraint of our life, or the spirit of the age, one thing or another, shuts out our energies from their desired scope; every one seems to be tending different ways and following different aims; our experience is all failure and distraction, and we try to console ourselves by fancying the sympathy and the achievement which we know in our hearts will never be ours. But there are ages of the world, ages when the efforts of many tend in one direction, and when a man may dream never such great things, and his dreams, or something better than his dreams, shall come true; for his imagination, at its wildest, only bodies forth something which a thousand willing hands are ready to make real, and at its hottest is only on fire with the unuttered needs of a myriad kindred hearts. The thirteenth century was such an age in Italy, for some at least of her children. With all its dissensions, with all its banishments, with all its spite of bitterness, it was an age not of prose but of poetry, not of failure but of achievement. At the dawn of the age St. Francis lay and dreamed his dream of nameless enterprise, high and holy, and knew not yet what call was upon him. But within a score of years he had found out his quest, and dared it, and won; through him the poor and needy had learned the meaning of the words of Christ; through him, for good or ill, the hearts of men were attuned, for three hundred fruitful years, to the authority of the heirs of Peter. He had gone forth in reproach and nakedness, and had chanted alone, in his mother-tongue, upon his mother-hills, his hymn in praise of the Lord his God for his brother the sun and his sister the moon, and for the wind, and for fair weather, and all weathers; a few years more, and a thousand passionate tongues had caught up his accents, and all Italy pealed with canticles that taught the people to see in their God the most gracious of cottage children, and in his mother, blessed among women, the sweetest and most patient of peasant mothers. And at the close of this age, Giotto, helping as a boy among older hands to set forth the miracles of St. Francis in that "visible speaking," as Dante calls it, which was a new thing among the people —Giotto, too, as a boy, had dreams beyond his present performance. Arnolfo and other famous architects were building churches and cemeteries and council-halls in the new manner which had come in with the congregations of the preaching and begging friars. And the young Giotto, in the backgrounds of his paintings, had to invent the stateliest pavilions and canopies and churches in

that manner that he could, before ever he had had the chance of building one in real marble. Then at last, after those busy years in which, with color spread over many a chapel and chamber wall, he had given an expression the most just, grave, and simple to the great thoughts of which the time was full, he was called back with honor to his native city, and appointed over a work in which he could realize, and more than realize, all those building-dreams of his youth. He enters upon the inheritance of Arnolfo; he takes up Arnolfo's art of rich surface incrustation or inlay, and perfects it with a hundred new and lovelier delicacies of design; he builds this mighty tower at whose summoning clang the people shall flock for evermore to worship and to festival; he builds it four-square, plumb from plinth to cornice, and flanked at the four angles with four aery piers; he divides it into bands of subtilest proportion; he pierces each division with exquisite variety of tracery; he panels the snow-white marble with fair geometries of color and dark; he incrusts this tower of his building with living stars and flowers and diamonds of stone; he outdoes all dreaming, for the hearts of a mighty people are in his heart, and in his hands are the strength and cunning of all theirs together.

Of this tower, it is a particular part of the sculptured decorations which we are now to examine in detail. That the stamp of Giotto's invention is upon the scheme there is no doubt, but whether he himself turned sculptor in his old age, and actually wrought upon the marble, we cannot tell. The time between his appointment to the cathedral works and his death was only two years, and must have been too multifariously filled, one would say, to leave him time for such exertion. Tradition is uncertain on the point. Vasari says, in one place: "If that is true which Lorenzo Ghiberti left written—and I for one hold it to be most true—Giotto not only made the design for this bell-tower, but also sculptured part of those stories in marble in which are represented the beginnings of all the arts." In another place, the same Vasari says of Andrea Pisano: "What is more, he made, after the design of Giotto, those little figures of marble which stand for a finish to the doorway of the campanile of Santa Maria del Fiore; and round about the said campanile, in certain lozenges, the seven planets, the seven virtues, the seven works of mercy" (and six, Vasari should have added, out of the seven sacraments) —"small figures in half-relief, which were greatly praised in their day." The probability is that Giotto before his death gave the general plan of these decorations, and that Andrea Pisano was the sculptor charged to superintend their execution. Andrea da Pontedera, called Andrea Pisano, was the greatest and most complete master of the earlier school of Tuscan sculpture. That school has its rise in the middle of the thirteenth century with Nicholas of Pisa, who, from a study of the sculptures on ancient sarcophagi, and perhaps from other sources of discipline of which we cannot recover the history, revived much of the technical excellence of the old Roman school. Only he did not revive the old classic gift of grouping the figures of a composition so that they should fill the given space agreeably, and stand in clear, distinct, natural relations with one another. The figures in his reliefs, taken singly, are often well proportioned and skillfully wrought, but crowded and jumbled together with rude awkwardness and confusion. John of Pisa, the son of Nicholas, was a still greater sculptor than his father, and great especially in his power of dramatic expression, and in the thoughtful invention of allegorical symbols and personifications. The same expressive power and hold upon the facts of life, the same justness and force of imagination, also formed part of the greatness of the painter Giotto, who was younger than John of Pisa by some thirty years. But Giotto had another greatness of his own; in his paintings he revived perfectly that ancient art of clear and noble distribution, of placing his figures at right intervals and in right and expressive relations with one another. And this art he seems to have imparted to his contemporary Andrea, called Andrea the Pisan because he was at first the pupil of John of Pisa. Andrea the Pisan is the first Tuscan sculptor who reaches central excellence in his art. To more than the technical skill of Nicholas he unites all the dramatic and all the imaginative power of John, and all Giotto's noble arrangement and simple directness in telling a story. The most famous work of Andrea, and that which cost him most labor, was the bronze gate which he wrought for the Baptistery of Florence; on it were represented allegorical figures, and scenes from the life of St. John the Baptist. This is the earliest of the three celebrated bronze gates of the Baptistery. The other two, done by Ghiberti a hundred years later, have been far more praised, but the truth is that Ghiberti tried to go beyond the necessary limitations of sculpture, and that, in spite of the extreme grace and accomplishment of his work, that of Andrea is the better conceived, the purer and more really classical, of the two. When people talk of classical art, they are too

apt to think only of the consummate accomplishment of the Greek artists, of their profound sense of the beauty of the human body, and their unexampled power of representing all the aspects of that beauty in bronze or marble. That, indeed, is one of the great distinctions of Greek art; but an equally essential distinction of the Greek artist lies in simplicity, in manly justness and directness of imagination, in his habit of expressing, without a shadow either of affectation or superfluity, exactly that which he desires to express and no more. And in all these qualities the early school of Tuscan sculpture in the fourteenth century is much nearer the Greek than the more accomplished school of a century later. Andrea Pisano had as stanch a sense of fact and as high a sense of dignity as any artist in the whole history of art. Andrea Pisano knew a great deal, too, about limbs and draperies. He could design and place them, we shall see, as well as any one, though he certainly could not render the subtilty and richness of their living surfaces as well as either the Greeks before or the Renaissance sculptors after him. And what accomplishment he has, in this or any other part of his craft, he does not force upon our notice. He leaves his backgrounds coarsely roughened with the chisel, his accessories sometimes blocked out barely enough for recognition; and even in the main subject he does not push his work very far, but is content as soon as ever he has got the spirit and essence of his subject well expressed. And in the expression of that essence he shows—or he and Giotto show together—a justness and dignity of thought, a grave and sure imaginative penetration, which raise the work to the level of the highest which has been done by man.

I call the series Giotto's "Gospel of Labor" because it is conceived in the spirit of a citizen who, in an industrial community, deliberately applies himself to commemorate the growth of industries. With the sculptured decorations of the upper courses of the tower, as they are mentioned in Vasari, and may be seen to this day, we have nothing to do. Those symbolical figures of the planets and the virtues, with the other figures of the apostles in niches (many of them executed by later hands), would be a study of the utmost interest; but they are too high up to be clearly seen, and to photograph them would be a considerable undertaking. Let us only take note of them as a part of the general scheme, and go on to the examination of those panels in relief—each being of hexagonal shape, and inclosed within a moulded border—which are well within sight, and which especially concern us. "Those stories in marble in which are represented the beginnings of all the arts"—here we must remember that it was a new thing in those days for an artist to range at large among subjects of his own choice. It is hard for us to realize how firmly, in the middle age, art was bound to the service of the Church alone, and to a fixed range of stock representations. John of Pisa was the first sculptor of the revival who invented free symbols and allegories of his own, or who, in works like the public fountain of Perugia, associated with figures of saints and apostles subjects of secular and practical life. In the decorations of the Florentine bell-tower this spirit of freedom has advanced a great stride farther. Florence was an industrial, a commercial, a manufacturing community, and the Florentine sculptor will adorn the lowest course of the great tower, the symbol of Florentine pride and unity, with a plain and practical history of the sources of his city's prosperity.

II.

The chronicle begins, like all mediæval chronicles, with the beginning of the world. Throughout the middle age, the creation and the fall of man formed the indispensable first scenes in every record of general or of local history, whether figured in color upon the pages of written books, or in sculpture within the enriched recesses of cathedral-fronts. Neither the sentiment of piety nor the desire of completeness could be satisfied without thus going back in every case to the sacred origin of things as revealed in the book of Genesis. Accordingly the first two of our Florentine series, beginning at the west side of the tower, are the familiar subjects of the birth of Adam and the birth of Eve. Paradise is suggested by a tree or two roughly carved in the background; the draped and dignified figure of God the Father stands, in the first scene, over the first-born man, and, in the second, helps into existence the first-born woman, who springs from the side of the man while he lies collapsed in sleep. Thus far there is no departure from traditional treatment, only a dignity, a simple grace and expressiveness in the grouping, which assert the new-born genius of Italian art. Beautiful as these two groups are, however, it happens that we can see the same subjects carved, more beautifully and more expressively still, by another Italian hand at nearly the same time. On the front of the famous cathedral of Orvieto, the spaces on either side of the three great doors are

richly wrought with carvings in relief, said to be the work of John of Pisa and his scholars—into the question who really did them I cannot enter. They are among the most masterly inventions in the whole range of sculpture, some of them very grim and terrible; but, besides the terror and grimness, those lovely subjects of the creation of Adam and Eve, each birth being represented in two separate scenes, appeal to us with all the purer charm.

To return to the Campanile, it is in the third subject that our sculptor begins to assert his originality and his special purpose. In ordinary course, we should now expect the sequence of the temptation—the fall and the expulsion. We find, instead, Adam and Eve at labor after the fall, and their labor conceived not as a curse, but rather as the type and source of all necessary and beneficent industries. It is a charming natural picture of the days when Adam delved and Eve span—the man working patiently with his spade, the woman standing beside him with her loaded distaff, both clad in suits of skins. Next, we go on to the origin of pastoral industry. In this, and in two or three more subjects of the series, the artist has continued to think of the book of Genesis and to seek his types among the patriarchs of the Old Testament. The quaint aged figure sitting cross-legged at the entrance of his tent is Jabal, the father of such as dwell in tents and of such as have cattle. With a few simple strokes, not without humor, the sculptor has expressed the whole root and essence of the matter. The form of the tent fits conveniently into the top of the hexagon; the cross-legged patriarch lifts the tent-flap to look out upon his wealth in flocks and herds, which is symbolized by three grazing sheep and a shepherd-pup too young for responsible service—the squatted, blunt-muzzled puppy whom Mr. Ruskin has made famous, and in whose lineaments all the pertness of his kind seems concentrated. After the first shepherd follows the first musician—after Jabal his brother Jubal, the father of all such as handle the harp and organ. This patriarch's tent, again fitted naturally into the two upper and two perpendicular sides of the hexagon, is looped up so as to be almost quite open; we see him seated in profile at his work-table, the end of which is fitted with a tool-rack, and carved with mouldings in the taste of the Tuscan-Gothic of the time. He leans forward in the eagerness of invention, his long hair falling back upon his shoulders, and blows hard through the first formless instrument, a great uncouth tube, which he has fashioned. Next to the sons of Adah comes the son of Zillah, Tubal-cain, the instructor of every artificer in brass and iron; and in him we have a somewhat less noble countenance, not quite so grand a flow of hair and beard, but rendered with the same rough unerring strokes, the same long drapery, with its folds, and its expression of the body beneath, not a whit less rightly understood than in the most accomplished later art. This third patriarch sits at his forge, his stool a little tilted in the intentness of his work, and holds the iron upon the anvil with the pincers in his left hand; the right, which managed the hammer, being lost. The bellows are in their place behind him; tools upon the ground in front; and a spade and axe-head nailed up indicate the wares of his fashioning.

The invention of wine comes in the seventh place, and is symbolized in the usual way, with the subject of the drunkenness of Noah. After this the chain of Old Testament subjects is broken. Man has learned to toil and spin, to keep flocks and herds, to labor at the forge, to solace himself with music and with wine; it is one of his speculative and not his practical ingenuities that comes next. The eighth sculpture, the first on the south face of the tower, and, perhaps, the noblest of them all, shows us a holy seer seated with upturned countenance at a table, carved more delicately than the table of Jubal, upon which stands the figure of an armillary sphere; with his left hand he directs a primitive quadrant working on an upright pivot set likewise on the table. Some of the signs of the zodiac are indicated in low-relief on a belt across the background; over his head the sculptor has turned the arc of a great circle in strong projection, to indicate the pole of heaven, and has filled the narrow strip above this with a quire of little human or angels' heads roughly carved, to indicate the quires of the stars. This is astronomy; but the subject seems scarcely in the place and order among the rest where we should expect to find it. Astronomy or astrology, according to the conception of those times, was one of a fixed group of seven arts or studies called liberal. The middle age loved to number everything by groups or families of seven—the seven virtues, the seven sins, the seven planets, the seven sacraments, and the like. So there were also seven arts or sciences supposed to include the whole circle of liberal culture. These seven were in their turn composed of a group of three, called the trivium, and a group of four, called the quadrivium. Grammar, logic, and rhetoric, made up the trivium; arith-

metic, astronomy, geometry, and music, the quadrivium. From the thirteenth down to the sixteenth century, symbolical figures of these seven liberal studies are among the most frequent representations of art. Sometimes each study is typified by the personage of a particular master famous for having excelled in it, as grammar by Priscian or Donatus, geometry by Euclid. This is the mode of representation used in the main by our sculptor of the Campanile; but not in any strict traditional way. Rather, though in a figure like this searcher of the stars he has no doubt had in his mind some ancient astronomer of renown, Thales or Meton or Ptolemy or Hipparchus, yet it is not the person but the idea, the soul and essence of star-searching and star-worshiping, which he has been really bent on thinking out and exhibiting. Nor could that idea be possibly shadowed forth in loftier or more speaking lineaments. Sometimes we find the seven studies treated in a different way from this, and each personified in the figure of a woman, whose guise and attributes tell us what she stands for. Of this treatment much the most beautiful example is in a famous set of Florentine engravings of the fifteenth century, the playing-cards of Mantegna, as they used in error to be called. Astronomy is there represented, not by an old man seated, but by the standing figure of a lovely and inspired woman, who gazes into a globe set with stars.

Sometimes the two kinds of type are combined; the chief instance of this is in a fresco by one of the followers of Giotto, where the sages of the several sciences sit in the lowest tier of the composition, and women-figures representing the sciences themselves are enthroned above them.[1] But, however represented, we are accustomed to find these liberal arts in a group by themselves; and, in a scheme like the present, we should expect them to follow and form the climax of the series of the manual and practical arts. Whereas we have already had one type of music in the person of Jubal, presently we shall find two others of the same art; and now we have astronomy coming immediately after the drunkenness of Noah. The reason for this irregular order most likely is that the series, though it may have been systematically conceived at the outset, was put up by those who carried on Giotto's work after his death, not systematically, but at hap-

[1] This fresco in the Spanish Chapel of the Church of Santa Maria Novella has been minutely described by Mr. Ruskin in the fifth of his "Mornings in Florence."

hazard, according as each subject chanced to come finished from the studio.

The next sculpture shows us the operations of building. Course after course is being added to a great square tower, and from within the tower the figure of the master-builder half emerges at the top, his assistants on either hand laying stone upon stone at his bidding. This is perhaps the rudest of the whole series; at least it is the only instance here in which, as in primitive Italian painting, the figures are drawn of disproportionate dimensions, the master-builder being much bigger than his companions. For the rest, the scaffold and ladders are of perfectly practical construction, and the essential facts of the art in question, as in all the subjects of the series, are expressed with absolute and simple pertinence. Here, again, the artist had probably in his mind some builder out of the Bible—how Enoch builded him a city, or else the presumptuous builders of the Tower of Babel. This last is what the subject looks most like; and we shall presently see another case in which the artist has certainly made his choice for warning and not for example, and has represented the enterprise of man pushed to overweening pitch. Next to building comes pottery; and this is treated as the business of womankind. A superintendent, or mistress of the works, sits on a raised seat at one end, testing, apparently, each vessel as it is brought her, and ranging on a shelf those that are truly wrought; before her stand other women carrying cakes of clay strung ready to be fashioned. In this group, unfortunately, the marble is in parts much bruised and blackened, and especially in the faces of the women, so that we can hardly realize its original aspect.

At the point we have now reached, the artist seems to have had the idea of alternating with the industries of woman, in furnishing and plenishing the house within, the industries of man in subduing the world without to his service. Next after the first potters comes the first adventurer on horseback; and assuredly, out of the Elgin marbles, there does not exist a figure in which the freedom and eagerness of riding are more nobly expressed. The gallop of the horse is a little stiff and misunderstood, the two hind legs being set to the ground and the two fore legs lifted together, as usual in early art; yet even in the horse there is more life than we are accustomed to find in the design of horses until we come to quite modern times. And nothing can be truer than the grip of the youthful horseman with his thighs as he rides bare-backed, nothing

more expressive of movement and the delight in movement than the backward drift of his hair and short cloak, and the urging gesture of his raised right arm. The twelfth sculpture takes us within-doors again, and shows us two women at the loom, one seated and the other standing. Here is the type of an industry which meant more to Florentines than to any other people. The weaving of fine cloths was one of the earliest and chief sources of the prosperity of the city. Not only the flocks of Tuscany and the Apennines sent their fleeces to be made up in the looms of Florence, but woolen fabrics were sent thither from all parts of Europe to have the last finish put upon them, and to be either reëxported or retailed by Florentine traders. Of the seven trade guilds or arts, which were called the seven greater in the city, two, and those among the wealthiest and most powerful, were concerned in this industry. One of these was the guild called Calimala, otherwise the guild of *mercatanti* (merchants), the word merchant being used for dealers in cloth from France and Flanders. The second weaving guild was called specifically the guild *della Lana*, of wool; and it was to the piety of this body that Florence owed the existence of her Campanile herself. The guild had come forward at a time when the cathedral works had languished for some years, and had offered to defray the costs of its completion; and it was in pursuance of that offer that Giotto had been appointed to the task.

Next after the type of this great Florentine industry comes a subject not quite so plainly to be interpreted. An enthroned figure sits aloft in the midst; beneath his throne, on his left side, kneel two bareheaded patriarchs or elders, to whom he delivers what look like tables of the law; on the other side two more elders, wearing caps upon their heads, gaze up at him from within two several compartments of a kind of tabernacle; over these he holds up his right hand in benediction. In this noble group it is not hard to appreciate the expressive dignity of the personages, and the grace as well as power of the sculptor in the draperies that fall, with a perfect natural flow, over the knees of the enthroned and about the ankles of the front kneeling figure. But it is harder to recognize the precise signification of the subject. It is evidently some type of divine law and law-giving; the enthroned figure within the almond-shaped canopy is evidently God the Father; and we may suppose that with his left hand it is the tables of the ten commandments that he is delivering. The Mosaic law being symbolized on this side, the robed and flat-capped personages within the canopies on his other hand would be doctors standing for the two branches, civil and canonical, of Christian law. This great twofold division of civil and church law is constantly brought before us by mediæval art; for instance, in the scheme of the great fresco which we have already mentioned, each branch is separately symbolized in the figure of a woman, and for the historical representative of canon law stands Pope Clement VI., for that of civil law Justinian.

The hero of the next subject is again the usual patriarchal type of the human race, but disguised this time in a strange vesture, and bent upon a hazardous enterprise. He wears a close-fitting suit of feathers, and has fitted to his shoulders an immense pair of wings, which he manages by means of straps on the inside of each wing, through which he passes his hands—in this practical, this working way is everything thought out. He gazes, with his head thrown back, confidently skyward as he leans forward to begin his flight; under his feet we see an adze and other discarded tools of his labor. Here, it seems, the designer has gone to pagan legend to find for the builders of Babel a companion in presumption. The rash artisan can be no other than Dædalus. This subject is the last on the south face of the building. First on the east face follows an enterprise only one degree less daring. The first navigators put to sea in the first boat; and what a sense of peril and awe, what solemn tempting of the unknown and the mysterious, the sculptor has expressed in the looks and action of these mariners—two of them rowing, or rather pushing; for, as the carved ripple indicates, they face toward the boat's bow, and keep an anxious lookout ahead; while the third and eldest steers in the stern with a great oar for rudder. Next, now that man has learned to search the stars and to obey laws, to weave and ride, to tempt the elements of air and water, he turns to a pursuit which we should have looked for long before—and in Florence of all places—the pursuit of war. Perhaps, however, there may be a reason in the present juxtaposition, and war may be purposely made the sequel of commerce, emigration, and colonization. Here, at any rate, lies a murdered man on his back, his limbs stiff with death, his right hand clutching the soil, his head, with its hair flung abroad, fallen back in a hollow of the ground. Beside him stands his murderer, lifting sullen looks askance like one who would defy the remorse within him. One hand is set stubbornly

on his hip; with the other he holds his club to the ground, and about his shoulders he wears a lion's hide. The club and lion's hide are attributes proper to Hercules; otherwise these looks are the looks of Cain; and, naturally, Cain and Abel are the types of slayer and slain that we should expect in a series like this. But here, again, we shall understand the sculptor best if we think of his work not as setting forth the history of any single strife, but rather an abstract and central type of human strife in general.

We now return to peaceful industries, to tilling and transport. The first ploughman has invented the first plough, and drives it, holding the ox in very primitive fashion by the tail, through a deep and broken soil. This is one of the noblest in expression and most spirited in movement of the whole series. Tamer, but distinguished by the usual practical sense of the conditions of primitive construction, is the subject of the first wagoner or charioteer. The horse is yoked to a square car of roughly-bolted planks set on wheels, in the fore part of which stands the driver.

At this point the series is interrupted by a gable surmounting the entrance-door of the tower; so that on this, the third and east side, the number of subjects is five only, instead of seven, as on the west, south, and north. After the break between the door and the corner comes one of the sciences of the quadrivium — the science of geometry, represented by an aged philosopher, seated at a desk with a pair of compasses. The work is somewhat rude and ugly, and this philosopher of a less reverend countenance than his companions.

Turning the corner, we begin the series on the north side of the Campanile, the side which is next to the cathedral, with only a narrow space between the two. The first sculpture in this place shows us another bearded father, the father of painting. The guide-books call him Apelles, but he might at least as fairly be associated with Christian instead of pagan tradition, and named St. Luke. Like some of the earlier artificers of the series, he, too, sits intently stooping at his work, his stool tilted under him; he is painting away devoutly at an altar-piece, and some of his finished work of the same kind—a large and a smaller triptych, destined for the adornment of church-altars—are indicated in low-relief as being fastened to the wall of his studio. Next to him comes a companion workman, a father of sculpture (called in the guide-books Phidias), bending forward with mallet and chisel over his half-hewn images of marble. These two subjects have a special interest, because in them, so far as I know, we have the first historical recognition of the place and dignity of painting and sculpture among the other arts. When we look back —when posterity looks back—upon mediæval Italy and upon Florence, it is of painting and sculpture that we think first; these are the arts in which Italy is, for us, preëminent, and by which, for us, her memory is chiefly ennobled. But the people of those days did not think as we do of their own painters and sculptors. Painting and sculpture grew but gradually into repute and eminence; in the origin they were but subordinate branches of industries themselves subordinate. They did not find a place among that family of the liberal seven into which the intellectual discipline of man was theoretically divided. Neither did they find a place in that other family of seven into which the practical industries of men were, in the administration of this particular city, as a matter of fact organized. We look in vain among the seven great guilds of Florence for a guild of painters or a guild of sculptors. Lower down among the five lesser guilds only, we find one of masons and carpenters, or *masters in stone and wood;* and it is under this modest title that all painters and all sculptors were incorporated; being content to follow, in the order of trade precedence, after the tanners, after the retail clothiers, after the butchers, after the bootmakers. So slight being the practical inclination, on the part of those who have made for posterity the glory of Florence, to assert their own dignity in their own day, it gratifies our sense of justice to see these arts introduced here with due distinction among the rest.

With these figures of the fathers of painting and sculpture ends the sequence of the works done by the pupils of Giotto, and in days soon following Giotto's own. The remainder of the series have been carved by other hands a full century later. We have no record why the work was thus interrupted; perhaps only because this north side of the tower next the cathedral is a place of comparative concealment, where it would matter less than on the other three sides whether the ornaments were finished or not. At any rate, the last five subjects belong to the Florentine school of the first half of the fifteenth, not of the fourteenth, century. The difference is manifest in a moment to an eye at all accustomed to these things, not only in the character and conception of the figures, but in the details of furniture and ornament, which are no longer Tuscan-Gothic,

but early Tuscan Renaissance. Tradition assigns these concluding subjects to the hand of Luca della Robbia. Of the actual hand we cannot really make sure; but the conclusion is as good, in its manner, as the beginning. Only it is a different manner. We lose the sense of the primeval, the patriarchal, the broadly permanent, and ideal; we gain a sense of vigorous animation and contemporary reality. The liberal science of grammar is the first of the new series; and in it we are invited to think neither of Donatus nor Priscian, nor yet of any ideal father of grammar, but simply of any schoolmaster teaching little boys their elements in any Florentine grammar-school. Into the upper angle of the hexagon is fitted the top of a bookcase which serves as furniture in the background; on the left sits a stern-visaged, shaven pedagogue at his desk, in close cap and long, heavy gown; on the seat opposite him are two boys attentively learning, in the Florentine costume of the day. It is an admirable piece, but of a character essentially realistic, and makes us think instinctively of Villani's educational statistics—how in such and such a year of the fourteenth century there were in the primary schools of the city from 8,000 to 10,000 little boys and girls learning to read, and in six secondary schools about 1,200 learning arithmetic and algebra, and in four upper schools from 550 to 600 learning grammar and logic. In this case, again, it is very interesting to compare the parallel subject in the great fresco at Sta. Maria Novella, where a grammarian sits poring over a book, and over his head the allegorical representative of his science bears what seems a rod in one hand and a fruit in the other, and has a group of three kneeling children beside her. In the next compartment a young man is passionately disputing with his teacher; both are in flowing robes, and the sculpture is admirably spirited and accomplished. The pupil holds an open text-book, and points eagerly with his finger to some passage in support of his argument; the teacher, having both hands raised with a still more eager gesture, confutes him, it seems, out of his own superior knowledge. This may represent a lesson either in logic or rhetoric; the eagerness of the contention is perhaps more appropriate to the latter. Whichever of the two sciences we decide for here, the other we have to regard as for some reason omitted from the scheme. For concerning the three remaining subjects there is no doubt. In the first of these (and it is one of the least happy of the series) Orpheus, having a bruised and somewhat ignoble visage, sits against a tree in the midst of a wood and plays upon his lute; on one side a congregation of birds, and on the other of beasts of the forest, come drawn by the magic of his notes. Next—and the meaning of the subject is equally unmistakable—two Oriental sages in turbans and embroidered skirts stand facing one another in discussion; one holds up two fingers of his hand, the ordinary gesture of counting; the other is working with the abacus, the ordinary instrument of numerical calculation. This is arithmetic; and, as the sciences of number were supposed to come from the east, so these turbaned figures stand, no doubt, for sages of Babylon or Chaldea. The next sculpture is the last of all, and commemorates once more the art of music. At first sight we may be puzzled by this ungainly, bearded figure who sits facing us, listening with his head on one side, and tapping with two hammers of different sizes, one in either hand, on a small anvil. The anvil and hammers are not unlike those we find in representations of the goldsmith's trade; and for a father of goldsmiths we might perhaps have taken this personage were it not for a parallel figure which gives us the right clew in the fresco of the Spanish Chapel. Under the personification of Music, in that composition, sits an old man bearded like this one, only without the cap, and striking on a similar anvil with two similar hammers. Tradition calls that figure, with very doubtful authority, Tubal-cain. In the present series, however, as we have already had an earlier Tubal-cain, tradition, again doubtfully, calls this concluding figure the monk-musician Guido of Arezzo. Without asserting names, the analogy of the Spanish Chapel, and the attentive gesture of the head, make it certain that this last figure is a symbol of musical invention, and that the striker with the two hammers is listening to the difference of the two notes he strikes.

—*Macmillan's Magazine.*

MONTENEGRO.

By ALFRED TENNYSON.

THEY rose to where their sovran eagle sails,
They kept their faith, their freedom, on the height,
Chaste, frugal, savage, armed by day and night
Against the Turk; whose inroad nowhere scales
Their headlong passes, but his footstep fails,
And red with blood the Crescent reels from fight
Before their dauntless hundreds, in prone flight
By thousands down the crags and through the vales.
O smallest among peoples! rough rock-throne
Of Freedom! warriors beating back the swarm
Of Turkish Islam for five hundred years,
Great Tsernagora! never since thine own
Black ridges drew the cloud and brake the storm
Has breathed a race of mightier mountaineers.

MONTENEGRO—A SKETCH.

By WILLIAM E. GLADSTONE.

1. "Le Monténégro Contemporain." Par G. Frilley, Officier de la Légion d'Honneur, et Jovan Wlahoviti, Capitaine au Service de la Serbie. Paris, 1870.
2. "Montenegro und die Montenegriner geschildert von Spiridion Goptchevitch." Leipzig, 1877.

IT is sometimes said, in relation to individuals, that the world does not know its greatest men. It might, at least, as safely be averred, in speaking of large numbers, that Christendom does not know its most extraordinary people. The name of Montenegro, until within the last two years, was perhaps less familiar to the European public than that of Monaco, and little more than that of San Marino. And yet it would, long ere this, have risen to world-wide and immortal fame, had there been a Scott to learn and tell the marvels of its history, or a Byron to spend and be spent on its behalf. For want of the *vates sacer*, it has remained in the mute, inglorious condition of Agamemnon's predecessors.[1] I hope that an interpreter between Montenegro and the world has at length been found in the person of my friend Mr. Tennyson, and I gladly accept the honor of having been invited to supply a commentary to his text. In attempting it I am sensible of this disadvantage—that it is impossible to set out the plain facts of the history of Montenegro (or Tsernagora in its own Slavonic tongue) without begetting, in the mind of any reader strange, and nearly all are strange, to the subject, a resistless suspicion of exaggeration or of fable.

The vast cyclone of Ottoman conquest, the most formidable that the world has ever seen, having crossed the narrow sea from Asia in the fourteenth century, made rapid advances westward, and blasted, by its successive acquisitions, the fortunes of countries the chief part of which were then among the most civilized, Italy alone being excepted, of all Europe. I shall not here deal with the Hellenic lands. It is enough to say that Bulgaria, Servia (as now known), Bosnia, Herzegovina, Albania, gradually gave way.

Before telling the strange tale of those who, like some strong oak that the lightning fails to rive, breasted all the wrath of the tempest, and never could be slaves, let me render a tribute to the fallen. For the most part they did not succumb without gallant resistance. The Servian sovereigns of the fifteenth century were great and brave men, ruling a stout and brave people. They reached their zenith when, in 1347, Stephen Dushan entitled himself Emperor of Serbs, Greeks, and Bulgarians. In an evil hour, and to its own ruin, the Greek Empire invoked against him the

[1] Hor., "Od.," IV., ix., 25.

aid of the Ottoman Turks. In 1356 he closed a prosperous career by a sudden death. On the fatal field of Kossovo, in 1389, treachery allied itself with Ottoman prowess to bring about the defeat of the Servian army; and again it was by treacherous advances that a qualified subjection was converted into an absolute servitude. The West, with all its chivalry, can cite no grander examples of martial heroism than those of Marko Kraljevitch, so fondly cherished in the Servian lands, and of George Castriotes or Scanderbeg, known far and wide, and still commemorated by the name of a *vicolo* of Rome.

The indifference, or even contempt, with which we are apt to regard this field of history, ought to be displaced by a more rational, as well as more honorable, sentiment of gratitude. It was these races, principally Slavonian, who had to encounter in its unbroken strength, and to reduce, the mighty wave, of which only the residue, passing the Danube and the Save, all but overwhelmed not Hungary alone, but Austria and Poland. It was with a Slavonian population that the Austrian emperor fortified the north bank of the Save, in the formation of the famous Military Frontier. It was Slav resistance, unaided by the West, which abated the impetus of the Ottoman attack just to such a point, that its reserve force became capable of being checked by European combinations.

Among the Servian lands was the flourishing principality of Zeta. It took its name from the stream which flows southward from the mountain citadel toward the lake of Scutari. It comprised the territory now known as Montenegro or Tsernagora, together with the seaward frontier, of which a niggardly and unworthy jealousy had not then deprived it, and with the rich and fair plains encircling the irregular outline of the inhospitable mountain. Land after land had given way; but Zeta ever stood firm under the Balchid family. At last, in 1478, Scutari was taken on the south, and in 1483 the ancestors of the still brave population of Herzegovina on the north submitted to the Ottomans. Ivan Tchernoievitch, the Montenegrin hero of the day, hard pressed on all sides, applied to the Venetians for the aid he had often given, and was refused. Thereupon he, and his people with him, quitted, in 1484, the sunny tracts in which they had basked for some seven hundred years, and sought, on the rocks and amidst the precipices, surety for the two gifts, by far the most precious to mankind, their faith and their freedom. To them, as to the Pomaks of Bulgaria, and the Bosnian Begs, it was open to purchase by conformity a debasing peace. Before them, as before others, lay the *trinoda necessitas*, the alternatives of death, slavery, or the Koran. They were not to die, for they had a work to do. To the Koran or to slavery they preferred a life of cold, want, hardship, and perpetual peril. Such is their *Magna Charta;* and, without reproach to others, it is, as far as I know, the noblest in the world.

To become a centre for his mountain-home, Ivan had built a monastery at Cettinjé, and declared the place to be the metropolis of Zeta. What is most of all remarkable in the whole transaction is, that he carried with him into the hills a printing-press.[1] This was in 1484, in a petty principality; they were men worsted in war, and flying for their lives. Again, it was only seven years after the earliest volume had been printed by Caxton in the rich and populous metropolis of England, and when there was no printing-press in Oxford, or in Cambridge, or in Edinburgh. It was only sixteen years after the first printing-press had been established (1468) in Rome, the capital of Christendom; only twenty-eight years after the appearance (1456) of the earliest printed book, the first-born of the great discovery. Then and there—

"They few, they happy few, they band of brothers."[2]

voted unanimously their fundamental law, that, in time of war against the Turk, no son of Tsernagora could quit the field without the order of his chief; that a runaway should be forever disgraced, and banished from his people; that he should be dressed in woman's clothes, and presented with a distaff; and that the women, striking him with their distaffs, should hunt the coward away from the sanctuary of freedom.

And, now for four centuries wanting only seven years, they have maintained in full force the covenant of that awful day, through an unbroken series of trials, of dangers, and of exploits, to which it is hard to find a parallel in the annals of Europe, perhaps even of mankind.

It was not to be expected that the whole mass of any race or people should have the almost preterhuman energy which their lot required. All along, from time to time, the weaker brethren have fallen away; and there were those who said to Ivan, as the Israelites said to Moses, "Wherefore have ye made us to come up out of Egypt, to bring us unto this evil place?"[3] The great Ivan died in 1490, and was succeeded by his eldest son, George, who in 1499 was persuaded by

[1] Frilley and Wlahoviti, p. 18.

[2] Shakespeare, "Henry V." [3] Numbers xx. 5.

his Venetian wife to go back into the habitable world; not of Islam, however, but at Venice. Worse than this, his younger brother Stephen had gone with a band of companions to Constantinople, and proposed to Bajazet II. the betrayal of his country. He, and those whom he took with him, were required to turn Mohammedans, and they did it. None could be so fit, as traitors, to be renegades. They then set out with an Ottoman force for the work of conquest. They were met by George, and utterly defeated. But these victors, the men of the printing-press as well as of the sword, were no savages by nature, only afterward when the Turks in time made them so. They took back their renegade fellow-countrymen into Montenegro, and allowed them the free exercise of their religion.[1] On the retirement of George, which seems only to have become final in 1516,[2] the departing prince made over the sovereign power to the metropolitan. And now began, and lasted for three hundred and thirty-six years, an ecclesiastical government in miniature over laymen, far more noble than that of the popes in its origin and purer in its exercise, as well as in some respects not less remarkable.

The epithet I have last used may raise a smile. But the greatness of human action, and that of human character, do not principally depend on the dimensions of the stage where they are exhibited. In the fifth century, and before the temporal power arose, there was a Leo as truly great as any of the famous mediæval pontiffs. The traveler may stand upon the rock of Corinth, and look, across and along the gulf, to the Acropolis of Athens, and may remember, with advantage no less than with wonder, that these little states, of parochial extension, were they that shook the world of their own day, and that have instructed all posterity. But the *Basileus*, whom Greece had to keep at arm's-length, had his seat afar; and, even for those within his habitual reach, was no grinding tyrant. Montenegro fought with a valor that rivaled, if it did not surpass, that of Thermopylæ and Marathon; with numbers and resources far inferior, against a foe braver and far more terrible. A long series of about twenty prelates, like Moses, or Joshua, or Barak, or the son of Jesse, taught in the sanctuary, presided in the council, and fought in the front of the battle. There were among them many who were admirable statesmen. These were especially of the Nicgush family, which came in the year 1687 to the permanent possession of power: a power so little begirt with the conveniences of life, and so well weighted with responsibility and care, that in the free air of these mountains it was never coveted, and never abused.

Under the fourteen Vladikas, who had ruled for one hundred and seventy years before this epoch, the people of Montenegro not only lived sword in hand, for this they have since done and still do, but nourished in their bosom an enemy more deadly, say the historians,[1] than the pashas and their armies. Not only were they ever liable to the defection of such as had not the redundant manhood required in order to bear the strain of their hard and ever-threatened existence, but the renegades on the banks of the Rieka, whom they had generously taken back, maintained disloyally relations with the Porte, and were ever ready to bring its war-galleys by the river into the interior of the country. At last the measure of patience was exhausted. Danilo, the first Vladika of the Nicgush dynasty, had been invited, under an oath of safe-conduct from the Pasha of Scutari, to descend into the plain of Zeta, among the homes of his ancestors, for the purpose of consecrating a church. While engaged on this work, he was seized, imprisoned, and cruelly tortured.[2] At last he was released on a ransom of 3,000 ducats, a sum which the hillsmen were only enabled to make up by borrowing in Herzegovina. It was felt that the time had arrived for a decisive issue; and we come now to a deed of blood which shows that for those human beings with whom the Turk forced himself into contact, and who refused to betray their faith, there were no alternatives but two: if not savages they must be slaves, if not slaves they must come near to being savages.

It was determined to slay by night every one of the renegades, except such as were willing to return to the faith of their fathers. The year was 1702, and the night chosen was that which divided Christmas-eve from Christmas day. The scale was not large, but the operation was terrible; and the narrative, contained in an old *Volkslied*, shows that it was done under that high religious exaltation which recalls the fiery gloom of the "Agamemnon," and the sanguinary episodes of the Old Testament:

"The hallowed eve draws onward. The brothers Martinovitch kindle their consecrated torches. They pray fervently to the new-born God. Each drains a cup of wine, and seizing the sacred torches, they rush forth into the darkness. Wherever there was a Turk, there came the five avengers. They that would not be baptized were hewed down

[1] F. and W., p. 19. [2] Goptchevitch, p 6.

[1] F. and W., p. 21. [2] F. and W., p. 22. G., p. 8.

every one. They that embraced the cross were taken as brothers before the Vladika. Gathered in Cettinjé, the people hailed with songs of joy the reddening dawn of the Christmas-morning; all Tsernagora now was free!"[1]

The war had been a standing rather than an intermittent war, and each party to it was alternately aggressor and defender. The Turk sought to establish his supremacy by exacting the payment of the *haradsch*, the poll or military service tax, paid in kind, which sometimes, in the more open parts, as we may suppose, of the territory, he succeeded in obtaining. Once the collector complained that the measure used was too small. The tax-payer smashed his skull with it, and said, "That is Tsernagora measure."[2] But the Montenegrins were aggressive as well as the Turks. Of the fair plains they had been compelled to deliver to the barbarian, they still held themselves the rightful owners; and in carrying on against him a predatory warfare, they did no more than take back, as they deemed, a portion of their own. This predatory warfare, which had a far better justification than any of the Highland or border raids that we have learned to judge so leniently, has been effectually checked by the efforts of the admirable Vladikas and princes of the last hundred years; for, as long as it subsisted, the people could not discharge effectually the taint of savagery. It even tended to generate habits of rapine. But the claim to the lands is another matter; there is no lapse of title by user here; the bloody suit has been prosecuted many times in the course of each of twelve generations of men. That claim to the lands they have never given up, and never will.

From 1710 onward, at intervals, the sovereigns of Russia and Austria have used the Montenegrins for their own convenience when at war with Turkey, and during the war of the French Revolution the English did the like, and, by their coöperation and that of the inhabitants, effected the conquest of the *Bocche di Cattaro*. To England they owe no gratitude; to Austria, on the whole, less than none, for, to satisfy her, the district she did not win was handed over to her with our concurrence. She has rigidly excluded the little state from access to the sea, and has at times even prevented it from receiving any supplies of arms. Russia, however, from the time of Peter the Great, though using them for her own purposes, has not always forgotten their interests, and has commonly aided the Vladikas with a small annual subvention, raised, through the liberality of the czar now reigning, to some £3,000 a year,[1] the salary of one of our railway commissioners. Nor should it be forgotten that Louis Napoleon, seemingly under a generous impulse, took an interest in their fortunes, and made a further addition to the revenues of the prince, which raised them in all to an amount such as would equip a well-to-do English country gentleman, provided that he did not bet, or aspire to a deer-forest, or purchase Sèvres or even Chelsea porcelain.

The most romantic and stirring passages of other histories may be said to grow pale, if not by the side of the ordinary life of Tsernagora, at least when brought into comparison with that life at the critical emergencies, which were of very constant recurrence. What was the numerical strength of the bishop-led community, which held fast its oasis of Christianity and freedom amid the dry and boundless desert of Ottoman domination? The fullest details I have seen on this subject are those given by Frilley and Wlahoviti. The present form of the territory exhibits the figure which would be produced if two roughly-drawn equilateral triangles, with their apices slightly truncated, had these apices brought together, so that the two principal masses should be severed by a narrow neck or waste of territory. The extreme length of the principality from the border above Cattaro on the west to Mount Kom, the farthest point eastward of Berda, is about seventy miles; the greatest breadth from north to south is a good deal less; but the line at the narrow point from Spuz on the south to Niksich on the north, both of them on ground still Turkish, does not exceed twenty miles. The reader will now easily understand the tenacity with which a controversy seemingly small has just been carried on at Constantinople between the delegates of Prince Nicholas and the Porte; with *andirivieni* almost as many as marked the abortive conference of December and January, or the gestation of the recent protocol. At these points, the plain makes dangerous incisions into the group of mountains;[2] and from them the Turk has been wont to operate. The population of his empire is 40,000,000; and I believe his claims for military service extend over the whole, except the 5,000,000 (in round numbers) of free people who inhabit the Servian and Roumanian principalities. Let us now see what were the material means of resistance on the other side. About A. D. 1600 there are said to have been

[1] G., p. 9. [2] Ibid.

[1] Stated by Goptchevitch as high as £4,000 a year.

[2] F. and W., pp. 89-91.

3,500 houses and 8,000 fighting-men in Montenegro. The military age is from twelve to fifty; and these numbers indicate a population not much, if at all, over 30,000. This population was liable to be thinned by renegadism and constant war; but, since the early siftings, the operation of the baser cause appears to have been slight. On the other hand, freedom attracts the free, and tribes, or handfuls, of Turkish subjects near Montenegro have had a tendency to join it. Until a few years back it never had a defined frontier; it is only in recent times that its eastern triangle, that of Berda, has been added to Tsernagora proper. About 1800 the population had risen to 55,000; in 1825, to 75,000. In 1835 the official calendar of Cettinjé placed it at 100,000, and in 1865 at 196,000. This included the districts of Grabovo, Rudine, and Joupa, conquered under Prince Danilo. For the mere handful of mountaineers has been strong enough, on the whole, not only to hold, but to increase, its land. Yet, on the establishment of free Servia, a tendency to emigrate from the sterile rocks into that well-conditioned country was naturally exhibited; and two battalions, composed of the children of Montenegrins, helped to make up that small portion of the army of General Tchernaieff, on which alone, in the operations of the recent war, he could confidently rely.

While the gross population of Montenegro in men, women, and children, was slowly growing through three centuries from 30,000 to 50,000, we must inquire with curiosity what amount of Turkish force has been deemed by the Porte equal to the enterprise of attacking the mountain. And here, strange as it may seem, history proves it to have been the general rule not to attack Montenegro except with armies equaling or exceeding, sometimes doubling or more, in numbers, all the men, women, and children, that it contained. In 1712, under the Vladika Danilo, 50,000 men crossed the Zeta between Podgoritza and Spuz. Some accounts raise this force beyond 100,000.[1] Danilo assailed their camp before dawn on the 29th of July, with an army, in three divisions, which could hardly have reached 12,000 men. With a loss of 318 men he slew, at the lowest estimate, 20,000. And in these alone, so far as I know, of all modern wars, it seems not uncommon to find the slain among the Turks exceeding the gross number of the highland heroes arrayed against them. Great is the glory of the Swiss in their Burgundian wars for freedom; but can it be matched with the exploits of the bishops of Montenegro and their martial flocks? Once more the heart of the little nation relieves itself in song:

"The seraskier wrote to Danilo: 'Send me your paltry tribute, and three of your best warriors for hostages. Refuse, and I will lay waste the land from the Morea to the salt-sea[1] with fire and sword, and will seize you alive,[2] and put you to death by torture.' As he read this letter the Vladika wept bitterly. He summoned the heads of communities to Cettinjé. Some said, 'Give them the tax;' but others, 'Give them our stones.' . . . They determined that they would fight to the last man. They swore with one accord that all they would give the Turk should be the bullet-rain of their muskets."

And thus continues the tale. Three Montenegrins went down to the Turkish encampment by night, and traversed the slumbering masses; just as, in the tenth Iliad, Odysseus and Diomed moved amid the sleeping allies of Troy. Vuko, one of the three, said to his comrades: "Go you back; I abide here to serve the cause." They returned to Cettinjé, and said: "So many are the Turks, that, had we three all been pounded into salt, we should not be enough to salt a supper for them." How this recalls the oldest census in the world, the census of Homer, who says:[3] "Were the Achaians divided into parties of ten, and every Trojan employed in serving them with wine, one for each party, many a ten would lack a wine-server." But, not to terrify their friends, they added that this vast host was but a host of cripples. So the people heard mass, received the benediction of their Vladika, and then set out upon the errand of victory or death. Vuko had induced the enemy to rest by the Vladinia, on the plea that they would not find water between that stream and Cettinjé. Here, before dawn, came down on them the bullet-rain. They were slaughtered through three days of fight; and the bard concludes: "O my Servian brothers, and all ye in whose breast beats the heart of liberty, be glad; for never will the ancient freedom perish, so long as we still hold our little Tsernagora!"

The very next year, the Turks assembled 120,000 of their best troops for the purpose of crushing the mountaineers, whose numbers fell within the satirical description applied by Tigranes to the Romans: "Too many for an em-

[1] F. and W., p. 23. G., p. 10.

[1] G., p. 10. The Morea was not then Turkish. Does the "salt-sea" mean the White Sea?

[2] As opposed to the ordinary practice in these wars, of death on the field without quarter.

[3] Hom., "Il," ii., 128.

bassy, too few for an army." But even this was not enough of precaution. Thirty-seven headmen of Montenegro, who had proceeded to the Turkish camp to negotiate with the commander, were basely seized and put to death. The Turks now ventured to assail a force one-tenth of its own numbers and deprived of its leaders. They burned the monastery, they carried thousands of women and children into slavery, and then, without attempting to hold the country, they marched off to the Morea, while the men of Tsernagora descended from their rocky fastnesses and rebuilt their villages.[1] They powerfully befriended Austria and Venice in the war they were then waging, and, as was too commonly the case, were left in the lurch by their allies at the Peace of Passarowitz in 1719. The Turks accordingly made bold to attack them in 1722 with 20,000 men under Hussein Pasha. One thousand Montenegrins took this general prisoner, and utterly discomfited his army.[2] In 1727 another Turkish invasion was similarly defeated. In 1732 Topal Osman Pasha marched against the Piperi, who had joined them, with 30,000 men, but had to fly, with the loss of his camp and baggage. In 1735 the heroic Danilo passed into his rest, after half a century of toil and glory.

These may be taken as specimens of the military history of Montenegro. Time does not permit me to dwell on what is perhaps the most curious case of personation in all history, that of Stiepan Mali, who for many years together passed himself off upon the mountaineers as being Peter III. of Russia, the unfortunate husband of Catherine, and, in that character, partially obtained their obedience. But the presence of a prince reputed to be Russian naturally stimulated the Porte. Again Montenegro was invaded in 1768 by an army variously estimated at 67,000, 100,000, and even 180,000 men. Their force of 10,000 to 12,000 was, as ever, ready for the fight; but the Venetians, timorously obeying the Porte, prohibited the entry of munitions of war. Utter ruin seemed now at length to overhang them. A cartridge was worth a ducat, such was their necessity; when 500 of their men attacked a Turkish division, and had for their invaluable reward a prize of powder. And now all fear had vanished. They assailed before dawn the united forces of the Pashas of Roumelia from the south and Bosnia from the north. Again they effected the scarcely credible slaughter of 20,000 Turks with 3,000 horses, and won an incredible booty of colors, arms, munitions, and baggage. So it was that the flood of war gathered round this fortress of faith and freedom, and so it was that flood was beaten back. *Afflavit Dominus, ac dissipantur.*

In 1782 came Peter[1] to the throne, justly recorded, by the fond veneration of his countrymen, as Peter the Saint. Marmont, all whose inducements and threats he alike repelled, has given this striking description of him: "Ce Vladika, homme superbe, de cinquante ans environ, d'un esprit remarquable, avait beaucoup de noblesse et de dignité dans ses manières. Son autorité positive et légale dans son pays était peu de chose, mais son influence était sans bornes."[2] As bishop, statesman, legislator, and warrior, he brought his country safely through eight-and-forty years of scarcely intermitted struggle. Down to, and perhaps after, his time, the government was carried on as in the Greece of the heroic age. The sovereign was priest, judge, and general; and was likewise the head of the Assembly, not representative, but composed of the body of the people, in which were taken the decisions that were to bind the people as laws. This was called the Sbor; it was held in the open air; and, when it became unruly, the method of restoring order was to ring the bell of the neighboring church. Here was promulgated, for the first time, in the year 1796, by his authority, a code of laws for Montenegro, which had hitherto been governed, like the Homeric communities, by oral authority and tradition. In 1798 he appointed a body of judges, and in 1803 he added to the code a supplement. With the nineteenth century, in round numbers, commenced the humanizing process, which could not but be needed among a race whose existence, for ten generations of men, had been a constant struggle of life and death with the ferocious Turk. From this time the *haradsch* was no more heard of.[3] Here is the touching and simple account of the calm evening that closed his stormy day:

"On the 18th of October, 1830, Peter I., who was then in his eighty-first year, was sitting, after the manner of his country, by the fireside of his great kitchen, and was giving to his chiefs, assembled round him, instructions for the settlement of some local[4] differences which had arisen. The

[1] G., p. 12. [2] G., p. 13. F. and W., p. 25.

[1] F. and W., pp. 35-59.

[2] I quote from F. and W., p. 495.

[3] G., p. 21 n.

[4] Among the Plemenas, which may be called parishes; subdivisions of the eight Nahias, say hundreds. All Montenegro is but a moderate county.

aged Vladika, feeling himself weak, announced that his last hour was come, and prayed them to conduct him to the humble cell which, without fire, he inhabited as a hermit would. Arriving there, he stretched himself on his bed, urged upon his chiefs to execute with fidelity the provisions set forth in the will he had that day dictated to his secretary, and then, in conversation and in prayer, rendered up his soul to God. So died this illustrious man, whom a Slavonic writer has not scrupled to call the Louis XIV. of Tsernagora, but who in a number of respects was also its St. Louis." [1]

Thirty-five years after his death Miss Mackenzie and Miss Irby, in their remarkable tour, visited the country. They found still living some of those who had lived under St. Peter; and thus they give the report of him which they received:

"There are still with us men who lived under St. Peter's rule, heard his words, and saw his life. For fifty years he governed us, and fought and negotiated for us, and walked before us in pureness and uprightness from day to day. He gave us good laws, and put an end to the disorderly state of the country. He enlarged our frontier, and drove away our enemies. Even on his death-bed he spoke words to our elders which have kept peace among us since he has gone. While he yet lived, we swore by his name. We felt his smile a blessing, and his anger a curse. We do so still." [2]

The voice of his people declared him a saint. Did the Vatican ever issue an award more likely to be ratified above?

I have already indicated resemblances between the characteristic features of Montenegro and of Homeric or Achaian Greece. One of the most remarkable among them is the growth of men truly great in small theatres of action. Not Peter I. only, but his successors, will bear some comparison with those whom the great Greek historians of the classic period have made so famous. To Peter I. succeeded his nephew Radatomovo, aged seventeen years. He was thereupon invested with the ecclesiastical habit and the sovereignty, and in 1833, when aged only twenty, he received at St. Petersburg episcopal consecration. Sir Gardner Wilkinson informs us that he was nearly six feet eight inches in height, and thoroughly well-proportioned. His skill with the rifle was such that, when one of his attendants tossed a lemon into the air, he would readily put a bullet through it. At nineteen the cloud of Turkish war broke upon him from Scutari; for he had refused to accept a *berat* from the Porte, which would have sealed him as a vassal. The pasha's advanced-guard of several thousand men [1] was defeated by a body of 800 Montenegrins, at the head of whom the Pope Radoviti fell bravely fighting; and no more was heard of the invasion. But this Vladika, following up St. Peter's work, set his face sternly against all such lawless habits as remained in the country. In his modes of repression there are curious traits of manners. The man-slayer was shot,[2] but the thief was ignominiously hanged. In the matter of shooting there was a great difficulty, for the terrible usage of the *vendetta*—which had by no means been extirpated from the Ionian Islands twenty years ago—bound the kin or descendants of a man to avenge his death on the person who slew him. The expedient adopted was to shoot by a large platoon, so that the killer could not be identified. I read that, before brigandage and the *vendetta* could be thoroughly put down, some hundreds of lives [3] were taken—more, probably, than were ever lost in the bloodiest battle with the Turk. Internal reform, which partook of a martial character, was the great task of this reign. But not exclusively. Under him was performed one of the feats incredible except in Montenegro. Ten men in 1835 seized by a *coup-de-main* the old castle of Zabliak, once the capital of Zeta, held it for four days against 3,000 Turks, and then surrendered it only by order of the Vladika, who was anxious to avoid a war. Nearly all his battles were victories.

This giant had received at St. Petersburg a high education, and was a cultivated man. A friend of mine has seen and admired him at Venice. He goes by the title of "the hero, statesman, poet Vladika;" and his verse has given him a high place in Slav literature. He is thus described: [4]

"One while he was to be seen as a captain, sword in hand, giving an example of every military virtue at the head of his troops; another, as a priest and preacher, carrying the cross alone, and subduing his wild compatriots into gentleness; again, as an inexorable judge, ordering the execution of culprits in his presence, or as a prince incorruptible, and refusing all the favors by which it was sought to fetter his independence."

Down to his time, there had been a civil governor who acted under the metropolitan as sovereign; but the holder of the office was deposed for intriguing with Austria, and when the Vladika died at thirty-nine, no successor had been

[1] F. and W., p. 58.

[2] "Travels" of Miss Mackenzie and Miss Irby, p. 628 (ed. 1867). Also see Goptchevitch, p. 21.

[1] F. and W., p. 30. G., p. 23.

[2] G., p. 22.

[3] G., p. 39.

[4] F. and W., p. 62.

appointed. This, perhaps, tended to accelerate the change, which was effected on the death of Peter the Poet in 1851. But a share in it was due to that subtile influence, the love of woman, which has so many times operated at great crises upon human affairs. The young Danilo, the nephew of the deceased Vladika, designated for the succession, was attached to a beautiful girl in Trieste, and the hope of union with her could only be maintained in the event of his avoiding episcopal consecration, which entailed the obligation of celibacy. The Senate almost unanimously supported him in his determination; and thus was effected a change which perhaps was required by the spirit of the times. The old system, among other points, entailed a great difficulty with respect to regulating the succession, which, among a people less simple and loyal, would have been intolerable. So, then, ended that line of the Vladikas of Montenegro, who had done a work for freedom, as well as for religion, never surpassed in any country of the globe. Of the trappings and enjoyments of power, they had known nothing. To them, it was endeared as well as sanctified only by burdens and by perils. Their dauntless deeds, their simple, self-denying lives, have earned for them a place of high honor in the annals of mankind, and have laid for their people the solid groundwork on which the future, and a near future as it seems, will build.

Danilo did no dishonor, during his short reign, to the traditions of his episcopal predecessors. He consummated the great work of internal order, and published in 1855 the statute-book in force until 1876. In the war with Omar Pasha (1852–'53), the military fame of the country was thoroughly maintained, under admirable leaders, though as usual with inferior arms and numbers. During the Crimean struggle, he maintained the formal neutrality of his country, though it cost him a civil war, and nearly caused the severance of Berda from the ancient Montenegro.[1] In May, 1858, his brother Mirko revived and rivaled at Grabovo all the old military glories of Tsernagora. Having no artillery, and very inferior arms, the Montenegrins swept down from the hill upon the gunners of the Turks, and destroyed them. In this battle the Ottoman force, inclosed in a basin or *corrie*, without power of retreat, displayed a desperate valor, for which on most other occasions they have not been by any means so remarkable. Nor was their numerical superiority so manifold as it commonly had been. They were defeated with the loss of several thousand lives, fourteen guns, colors, baggage, and munitions. From the bodies of many dead were taken English as well as French medals, obviously granted for the Crimean War, which were seen by Miss Mackenzie and Miss Irby among the collection of trophies at Cettinjé.[1] The victory of Grabovo produced a great excitement among the rayahs of Turkey. But the great powers of Europe came to the help of the Porte and its huge empire against the Liliputian state, that is scarcely a speck upon its map. It had to abide a diplomatic verdict. A commission, sitting at Constantinople, accorded to it the advantage of establishing in principle the delimitation of its frontiers, and in 1859 admitted its envoy, notwithstanding the protest of Ali Pasha, to take part in its deliberations. But the powers had in 1857 determined at Paris that, in return for some small accretion, and for access to the sea, Montenegro should definitively acknowledge the suzerainty of the Porte.[2] Her refusal was positive, despite the wishes of the prince. It was to French,[3] not British, advocacy that she seems to have owed a declaration of May, 1858,[4] which acknowledged the independence of the Black Mountain.

[1] F. and W., pp. 65–'70. G., p. 35.

In August, 1860, Prince Danilo was shot on the quay of Cattaro. The assassin was prompted by a motive of private revenge, for which different grounds are assigned. Like his predecessors, he lived and died a hero. In what estimation he was held, let Miss Mackenzie and Miss Irby testify. On his death his body had been carried up the mountain, and deposited in a church. For many weeks afterward, as they tell us, this church was filled, morning, noon, and all night through, by his people, men, women, and children; and stalwart warriors were, as of old, dissolved in tears.

Danilo was succeeded by his nephew Nikita, the present Prince of Montenegro. He had not at his accession completed his nineteenth year. It is characteristic of the principality that his own father, Mirko, the victor of Grabovo, contentedly gave way to him. Goptchevitch, the brother of his aunt, Princess Darinka, acquaints us that he set out with two fixed ideas: 1. To prosecute the civilizing work among his people; 2. To liberate the sister Servian lands still in ser-

[1] Mackenzie and Irby, p. 610. [2] F. and W., p. 72.

[3] It is fair to say that there is, so far as I know, no English account of the affair.

[4] F. and W., p. 73.

vitude.[1] This writer appears disposed, in regard to the present sovereign, rather to play the part of critic than of eulogist, but ascribes to him great merit in his political conduct, and in the prosecution of social reforms. Soon after his accession, Montenegro was worsted, after a long resistance, in a war with Turkey. She had been driven to her crags, when diplomatic mediation brought about a settlement. It was then proved that an empire of 35,000,000 *could* gain the advantage against a tribe under 200,000. Only, however, when she could concentrate against it all, or nearly all, her forces; when she had a general, not a Turk, of the ability of Omar Pasha; when she had reformed her whole armament by means of European loans; and when Montenegro had but her old muskets and old ways. Since then a great change has taken place. The army has been organized in thirty battalions, 800 strong; and now for the first time we hear of an endeavor to establish a certain strength of cavalry. The fighting-men are reckoned at 35,000; but the military age begins at twelve. The obligation for offensive service runs only from seventeen; but it appears that the zeal of patriotism carries the people while yet boys into the ranks. The force available for general operations, between seventeen and fifty, amounts to 24,000. The arms have been greatly improved, two-thirds having breech-loaders, all (as is stated) revolvers, and most of them carrying the *handschar*. During the war from July to October, 1876, we heard much of the Turkish victories over a Servian army composed principally of peasants put suddenly into the ranks, with a *salting* of real soldiers; but very little, in comparison, of their failures and defeats in the conflict with Montenegro. Goptchevitch has supplied[2] a detailed account of the operations. I shall refer only to the most remarkable. On the 28th of July the men of Tsernagora encountered Muktar Pasha, and for once with superior force. Four thousand Turks were killed, but only seventy men of Montenegro. Osman Pasha was taken; Selim was among the slain. At Medun, on the 14th of August, 20,000 Turks were defeated by 5,000 of these heroic warriors, and 4,700 slain. On the 6th of September five battalions of Montenegro defeated Dervisch Pasha in his movement upon Piperi, and slew 3,000 of his men. On the 7th of October Muktar Pasha, with 18,000 men, drove three Montenegrin battalions back upon Mirotinsko Dolove. Here they were raised, by a junction with Vukotitch, to a strength of 6,000 men. Thus reënforced, they swept down upon Muktar, and, after an action of sixteen hours, drove him back to Kloluk, leaving 1,500 dead behind him. On the 10th of October Dervisch Pasha effected an advance from the south, until he found himself attacked simultaneously at various points, and had to retreat with a loss of 2,000 men. On the 20th of October Medun was taken, and the Ottoman general fled to Scutari, leaving garrisons in Spuz and Podgoritza. The armistice arrested this course of disasters, when the southern army (Dervisch) had been reduced from 45,000 to 22,000, and the northern (Muktar) from 35,000 to 18,000.

So much for that "indomitable pluck" of the Turks, which has since moved the enthusiastic admiration of a British minister.

Goptchevitch reckons the slain on the Turkish side at 26,000; on the side of Montenegro, at 1,000. And there is no wonder if we find the Montenegrins now aspire to breech-loaders and to cavalry; they captured from their enemies (with much besides) 12,000 breech-loaders and 1,500 horses.

Montenegro brought into action in all 25,000 men: 17,000 of her own, 2,000 allies, and 6,000 insurgents from the Turkish provinces—a fact, this last, highly indigestible for those who contend that rebellions in Turkey are not sustained by natives, but by foreigners. The entire Turkish force directed against Tsernagora is stated at the enormous total of 130,000. It was, of course, chiefly Asiatic.

It will be observed that the whole of these figures are taken from a work on the Slavonic side. The author has had the best means of information, and the statements are written not for our information, but for that of the sober and studious Germans. They are such as might at first sight well provoke a smile of incredulity. Yet, strange to say, they are in pretty close conformity with the general, the nearly unbroken, tenor of a series of wars reaching over four centuries. This is the race which, when asked for tribute, offered stones; whose privations were such that, on one occasion, having taken some hundreds of Turkish prisoners, they gladly accepted in exchange the same number of pigs; who clothe the coward in the garb of woman, but whose women freely grasp the rifle in the hour of need; yet whose men of war weep like women for the dead prince they love; and whose fathers in 1484 carried the printing-press with them to the mountains.

What became of that printing-press? Probably when, not long after the removal to the hills,

[1] G., p. 40. [2] Pp. 188–193.

a vast army of Ottomans penetrated to Cettinjé and burned the monastery, it perished in the flames. The act of carrying it there demonstrated the habits, and implied the hopes, of a true civilization. But those habits and those hopes could not survive the cruel, inexorable incidents of the position. Barbarous himself in origin, and rendered far more barbarous by the habitual tyranny incident of necessity to his peculiar position in these provinces, the Turk has barbarized every tribe about him, except those whom he unmanned. The race of Tsernagora, with their lives ever in their hand, have inhabited not a territory, but a camp; and camp-life, bad at the best, is terrible in its operation when it becomes continuous for twelve generations of men. It was only a fraction of the brutality and cruelty of Turks that in course of time was learned by the mountaineers. But even that fraction was enough to stir a thrill of horror. Of the exposure of the heads of the slain I cannot speak so strongly as some, who appear to forget that we did the same thing in the middle of the last century which Montenegro carried on into this one; and that a Jacobite, fighting for his ancient line of kings, may fairly bear comparison with a race which had claimed a commission not only to conquer all the earth, but to blast and blight all they conquered. On both sides this was a coarse, harsh practice, and it was nothing more. The same cannot be said of the mutilation of prisoners. There was an undoubted case of this kind during the late war, when a batch of Turks had their noses or upper lips, or both, cut away. This is certainly very far less bad than burning, flaying, impaling, and the deeds worse even than these in Bulgaria, for which rewards and decorations have been given by the Porte. But it was a vile act; and we have to regret that no measures have been taken by the British agency which published it to trace it home, so that we might know the particulars of time, place, and circumstance, and learn whether it was done by Montenegrins or by their allies, who have not undergone the civilizing influence of the last four reigns in Tsernagora. The unnaturally severe conditions which have been normal in Montenegrin existence will be best of all understood by the ideas and usages which have prevailed among themselves toward one another: 1. We are told that death in battle came to be regarded as natural death, death in bed as something apart from Nature; 2. Agriculture, and, still more, all trading industry, fell into disrepute among these inveterate warriors, and the first was left to the women, while they depended upon foreign lands to supply the handicrafts; 3. When a comrade was wounded in battle so as to be helpless, the first duty was to remove him; but, if this were impossible from the presence of the enemy, then to cut off his head, so as to save him from the shame or torture which he was certain to incur if taken alive by the Turks. Not only was this an act of friendship, but a special act of special friendship. There grew up among the mountaineers a custom of establishing a conventional relationship, which they called bond-brotherhood; and it was a particular duty of the bond-brother to perform this fearful office for his mate. In fact, the idea of it became for the Montenegrin simple and elementary, as we may learn from an anecdote, with a comic turn, given by Sir Gardner Wilkinson.

When the Austrians and Montenegrins were fighting against the Turks, allies of the French, on a certain occasion a handful of men had to fly for their lives. Two Austrians were among them, of whom one had the misfortune to be what is called stout. When the party had run some way, he showed signs of extreme distress, and said he would throw himself on the ground, and take his chance. "Very well," said a fellow-fugitive, "make haste, say your prayers, make the sign of the cross, and I will then cut off your head for you." As might be expected, this was not at all the view of the Austrian in his proposal, and the friendly offer had such an effect upon him, that he resumed the race, and reached a place of safety. Under the steady reforming influences which have now been at work for nearly a hundred years, few vestiges of this state of things probably remain.

But I will dedicate the chief part of my remaining space to the application of that criterion which is of all others the sharpest and surest test of the condition of a country—namely, the idea it has embraced of woman, and the position it assigns to her.

This is both the weak, the very weak, and also the strong point of Montenegro. The women till the fields, and may almost be said to make them; for Lady Strangford testifies that she saw various patches of ground in cultivation which were less than three feet square, and it seems that handfuls of soil are put together even where a single root will grow. More than this, over the great ladder-road between Cettinjé and Cattaro, the women carry such parcels, bound together, as, being over ten pounds in weight, are too heavy for the post; and Goptchevitch records the seemingly easy performance of her task by a

woman who was the bearer of his large and long portmanteau.[1] Consequently, though the race is beautiful, and this beauty may be seen in very young girls, as women they become short in stature, with harsh and repulsive features. Nor is their social equality recognized, since they not only labor but perform menial offices for the men. One of our authorities[2] informs us that the husband often beats his wife. This, however, to my knowledge, was a practice which did not excite general repugnance, one generation back, among the Hellenic inhabitants of Cephalonia.

The portrait thus set before us is sufficiently ungainly: let us turn to its more winning features. Crime of all kinds is rare in Montenegro: Miss Mackenzie and Miss Irby inform us that in a year the jail had but two prisoners. But the crimes, or sins, which have reference to woman, are, whether in their viler or their milder forms, almost unknown. Not violation only, but seduction and prostitution, says Goptchevitch, are not found in Montenegro.[3] The old law of the country punished all unchastity with death—a law of which there seem to be traces also in Bulgaria. Everywhere the purity and modesty of the maiden enjoy an absolute respect; and a woman, in every defile, every hamlet of Tsernagora, is a perfect escort for the traveler. Moreover, even the French writer to whom I am so much indebted, and who seems to view this matter through a pair of Parisian spectacles, candidly admits that the Montenegrin woman is quite satisfied with her state. "La Monténégrine semble du reste se complaire dans ce rôle d'infériorité et d'abjection."[4] If the condition of the women was not Parisian, neither, it may be truly said, was that of the men.

The women have the same passionate attachment with the men to family and country, and display much of the same valor. Goptchevitch supplies two most remarkable examples. A sister and four brothers, the four of course all armed, are making a pilgrimage or excursion to a church. The state of war with the Turk being normal, we need not wonder when we learn that they are attacked unawares on their way, in a pass where they proceed in single file, by seven armed Turks—who announce themselves by shooting dead the first of the brothers, and dangerously wounding the second. The odds are fearful, but the fight proceeds. The wounded man leans against the rock, and, though he receives another and fatal shot, kills two of the Turks before he dies. The sister presses forward, and grasps his rifle and his dagger. At last all are killed on both sides, excepting herself and a single Turk. She asks for mercy; and he promises it, but names her maidenly honor as the price. Indignant, and perceiving that now he is off his guard, she stabs him with the dagger. He tears it from her hand, they close, and she dashes the wretch over the precipice into the yawning depth below.[1]

The second anecdote is not less singular. Tidings reach a Montenegrin wife that her husband has just been slain by a party under the command of a certain aga. Knowing the road by which they are traveling, she seizes a rifle, chooses her position, and shoots the aga dead. The rest of the party take to flight. The wife of the dead aga sends her an epistle. "Thou hast robbed me of both my eyes. Thou art a genuine daughter of Tsernagora. Come to-morrow alone to the border-line, and we will prove by trial which of us was the better wife." The Tsernagorine appeared, equipped with the arms of the dead aga, and alone as she was invited. But the Turkish woman had thought prudence the better part of valor, and brought an armed champion with her, who charges her on horseback. She shot him dead as he advanced, and, seizing her faithless antagonist, bound her and took her home, kept her as a nursemaid for fourteen years, and then let her go back to her place and people.[2]

Such, in the rudest outline, is the Montenegro of history, and of fact. Such it was. Such it is. But what will it be? On some points we may speak with boldness; on others it must be with reserve. However unskillful may be the hand which has inscribed these pages, it can hardly have expelled so completely from the wonderful picture both its color and its form as not to have left in it vestiges at least and suggestions of a character greatly transcending the range of common experience, and calculated to awaken an extraordinary interest. Montenegro, which has carried down through four centuries, in the midst of a constant surge of perils, a charmed life, we may say with confidence will not die. No Russian, no Austrian eagle will build its nest in the Black Mountain.[3] The men of Tsernagora, who have never allowed the very shadow of a Turkish title to grow up by silent prescription, will claim their portion[4] of an air

[1] G., p. 81. [2] F. and W., p. 153.
[3] G., pp. 76, 77. [4] F. and W., p. 150.

[1] G., p. 79. [2] Ibid., p. 78. F. and W., p. 159.
[3] In the arms of Montenegro appears a "sovran eagle" crowned. [4] F. and W., p. 500.

and soil genial to man, and of free passage to and fro over the land and sea which God has given us. It is another question whether their brethren of the Servian lands will amalgamate with them politically on an extended scale, and revive, either by a federal or an incorporating union, the substance, if not the form, of the old Servian state. Such an arrangement would probably be good for Europe, and would go some way to guarantee freedom and self-government to the other European provinces of Turkey, whether under Ottoman suzerainty or otherwise. There is another question deeper and more vital. Rudeness and ferocity are rapidly vanishing; when their last trace disappears, will the simplicity, the truth, the purity, the high-strung devotion, the indomitable heroism, lose by degrees their native tone, and their clear, sharp outline, and will a vision on the whole so glorious for them, so salutary and corrective for us,

". . . . Die away,
And fade into the light of common day?" [1]

To the student of human nature, forty years ago, Pitcairn's Island offered a picture of singular interest, no less remote morally than locally from common life—a paradise, not, indeed, of high intellect and culture, but of innocence and virtue. It became necessary to find for the growing numbers a larger site, and they were carried to Norfolk Island, when it had been purged of its population of convicts double-dyed. The spot was lovely, and the conditions favorable; but the organism would not bear transplanting, and the Pitcairners fast declined into the common mass of men. Is this to be the fate of the men of Montenegro when they substitute ease, and plenty, and power, and the pleasures and luxuries of life, for that stern but chivalrous wooing of adversity, the "relentless power," in which they have been reared to a maturity of such incomparable hardihood? I dare not say; they have a firmer fibre, a closer tissue, than ever was woven in the soft air and habitudes of Pitcairn; may they prove too strong for the world, and remain what in substance they are—a select, a noble, an imperial race!

In another point of view, they offer a subject of great interest to the inquiries of the naturalist. Physically, they are men of exceptional power and stature. Three causes may perhaps be suggested. The habits of their life have been in an extraordinary degree hardy, healthy, simple; if they have felt the pressure of want at times, they have never known the standing curse of plethora:

". . . . *Nec* nova febrium
Terris incubuit cohors."

Next, may not the severe physical conditions of the Black Mountain have acted as a test, and shut out from the adult community all who did not attain to a high standard of masculine vigor? Among other notable features, they are a people of great longevity. Sir G. Wilkinson (shade of Lewis, hear it not!) found among them, living together as a family, seven successive generations; the patriarch had attained the age of one hundred and seventeen, with a son of one hundred. A youth of seventeen or eighteen very commonly marries a girl of thirteen or fourteen.[1] But, thirdly, I conceive that moral causes may have coöperated powerfully with outward Nature in this matter. *Fortes creantur fortibus et bonis.* The men who went up with Ivan were men of great souls; and this greatness, transmitted with blood and fortified by habit, may have assisted in supplying us with what seems to be a remarkable case of both natural and providential selection.

For the materials of this sketch I have been principally indebted to the two works named at its head. They are, I believe, the best on the subject; one is large and elaborate, the other, also full, coming down almost to this day. There is as yet no comprehensive book on Montenegro in our language. We have recently had articles on it in the *Church Quarterly Review* and in *Macmillan*, the latter guaranteed by the high name of Mr. Freeman. Sir Gardner Wilkinson led the way thirty years ago with some chapters on the Mountain in his Dalmatian work. Dr. Neale has supplied some very brief but interesting notices. Lady Strangford's sketch is slight and thin, but with ample power of observation. Miss Mackenzie and Miss Irby were able to bestow far more of time and care on a subject well worthy of them, and have probably made by much the most valuable contribution extant in our language, under this as under other heads, to our knowledge of those South Slavonic provinces whose future will, we may humbly trust, redeem the miseries of their past. "Whereas thou hast been forsaken and hated, so that no man went through thee, I will make thee an eternal excellency, a joy of many generations." [2]—*Nineteenth Century*

[1] Wordsworth, "Ode on Recollections of Childhood."

[1] G., p. 76

[2] Isaiah lx. 15.

THE GERM-THEORY AND SPONTANEOUS GENERATION.

PASTEUR—TYNDALL—BASTIAN.

ON almost all subjects it is pleasant to know that, in spite of occasional fluctuations, our acquaintance with Nature advances with a steady pace. Science makes good her ground as she marches forward from age to age. The controversies of one epoch become the certainties of the next. The errors of early investigators are slain never to revive. The doubts and mists of a tentative philosophy crystallize by degrees into true principles of science, which evolve fresh doubts and mists destined to be transformed in their turn by the finer alchemy of a more instructed future. The most bigoted opponents of modern inquiry give at this day a ready assent to doctrines which were once denounced as diabolical heresies. Even the pope would shrink from cursing the memory of Galileo, and is forced to yield a reluctant or unconscious homage to the triumphant career of scientific truth.

There is one seeming exception to this law of continuous advance—one controversy which has maintained itself in full vigor from the earliest dawn of thought to its latest development, and is at least as animated now as it has been at any stage of the world's history. Thousands of years ago men speculated with more or less agreement on the mystery of the origin of life, and though modern work has multiplied the materials for speculation, it seems to have left us as far as ever from agreement. No one, indeed, doubts now that all the higher types of life with which the earth teems have been developed by the patient process of evolution from lower organisms, and in logical consistency we are bound to trace back the series to the simplest forms of protoplasm which the microscope reveals to us as living units. But all this is but the outcome of life from life, and leaves us without an approach to a solution of the mighty question of the origin of life. There was a time when the earth was a red-hot melted globe on which no life could exist. In course of ages its surface cooled; but, to quote the words of one of our greatest *savants*, "when it first became fit for life there was no living thing upon it." How, then, are we to conceive the origination of organized creatures? Did moulds and confervoid growths, or some yet simpler primordial germs, spring once for all into existence by a fiat of creative power to become the fruitful parents of all vegetal and animal life, or is the same law which brought out of the dust of the earth the earliest of its organic inhabitants still in operation, and are we to imagine that the lowest organisms, constantly being drafted into higher grades as the work of evolution goes on, have their ranks as constantly replenished by a fresh development of life from the so-called dead materials of the parent earth? These are questions to which *a priori* dreams can give no answer. According to his temperament a man may feel, he knows not why, impelled to prefer the one or the other hypothesis. To one mind it seems easier to fancy a single discontinuous effort of life-creating power, while another rests more naturally in the faith that the law of continuity which dominates all other phases of Nature will ultimately come to be accepted as indicating the unceasing operation of the same agency which once, at any rate, must have bridged over the gulf between living and non-living matter.

Thus scientific belief has come to be divided, and, indeed, has almost always been divided, between two hypotheses: one—let us call it the germ-theory—which declares that no life has ever been evolved (except in the remotest periods of the earth's history), otherwise than from a living parent or a living germ; the other, familiarly though not very accurately styled the spontaneous generation theory, which declares that, now as of old, life does also spring *de novo* from molecular rearrangements of the atoms of dead organic materials.

The attitude of the one school has never been more truly pictured than in the eloquent words of Prof. Huxley, when, many years ago, he laid before the British Association the tenets of what he called, not his belief, but his philosophic faith upon this matter: "If it were given to me to look beyond the abyss of geologically recorded time to the still more remote period when the earth was passing through physical and chemical conditions which it can no more see again than a man can recall his infancy, I should expect to be a witness of the evolution of living protoplasm from not-living matter." The attitude of the opposite school has often expressed itself in some such shape as this: "I have no warrant

for supposing that the physical or chemical conditions of the earth were more favorable to life-evolution in the past than in the present. I recoil from a gratuitous assumption of discontinuity in Nature, and, if I were permitted to discern the movements of ultimate molecules, I should expect to behold primordial forms of life incessantly springing up from the same so-called dead but potentially living matter which, on any hypothesis, must at one time have developed them."

Analogical reasons, which are supposed to recommend these rival hypotheses, have been accumulated by their partisans with wonderful assiduity. On the one side, it is urged that all the more developed beasts and birds, fishes and plants, are multiplied by offshoots from a living parent, and that it is a relief to the mind to thrust back into a remote antiquity a process which obliterates the exaltation of living creatures over dead material. On the other, it is observed that the constant conversion of dead food into living protoplasm is the very condition of vital existence; that the earliest living products must have arisen by a similar process, without the stimulus afforded by contact with living cells; and that no reason can be assigned why the forces of Nature should be powerless now to do what unquestionably they did in the so-called infancy of the world. And arguments from analogy have unfortunately been reënforced by arguments from authority, and this almost as freely by the one school as by the other. For fashion may be traced in the world of science no less than in the world of society, and fashion has more than once changed sides with singular caprice in her estimate of the vital controversy. One of the first modern propounders of the maxim *Omne vivum ex vivo* was denounced as a wicked contravener of Scripture, which in his day was supposed to favor the theory of spontaneous generation. The later expositors of this once orthodox doctrine have been impartially condemned as materialistic enemies of natural religion. But all such carping passes by the truly scientific mind as idle wind. No authority, except the authority of experimental work, can weigh a feather in the balance. No *a priori* reasoning can give the victory to either creed. The deep mystery of the subject defies all shallow treatment; but not the less is it true, as Sir William Thomson has said with respect to this very question, that "Science is bound by the everlasting law of honor to face fearlessly every problem which can fairly be presented to her," and we may add that she is bound to face this problem cased in the same panoply of candor and armed with the same weapons of inductive investigation with which she has conquered all the domain which she now holds. Nor is there anything in the enterprise to justify despair. Once be sure that you can isolate a portion of dead matter, and the riddle is solved. If, after repeated and patiently varied trials, life uniformly fails to appear, the hypothesis of a single act, or at any rate a single epoch, of life-evolution becomes almost irresistible. If, on the other hand, life shows itself in a sufficient number of instances to exclude the probability of accidental error, the theory of what is called spontaneous generation must be accepted as a scientific truth.

That the controversy resolved itself into this purely experimental question has been frankly recognized ever since the time when experience was acknowledged to be the only basis of natural science. For many generations an almost unbroken succession of inquirers have striven to perform the crucial experiment which we have indicated, and, though sometimes one and sometimes the other party has for a time claimed victory all along the line, the struggle still maintains itself as fiercely as ever. Redi's inferences, adverse upon the whole to spontaneous generation, stood their ground for a century, till they were displaced by Needham's experiments. Needham, in his turn, was discredited by Spallanzani; and, in our own day, the battle has been continued by Pasteur and Pouchet in France; by Bastian, Lister, Sanderson, and Tyndall, in England; by Huitzinga, Cohn, Klebs, and Billroth, in Holland, Austria, and Germany; by Mantegazza, Cantoni, and Oehl, in Italy; by Wyman, in America; and by other inquirers, too numerous to mention, in all parts of the civilized world. The multitude of experiments which have been tried to elucidate this single point is almost countless, and as yet no generally accepted conclusion has been reached. It is such a simple matter to state the conditions of the requisite investigation that one is tempted at first sight to marvel at the persistency of the contest. There is absolutely nothing to be done but to take dead matter, isolate it from all contact with life, place it under favorable conditions for development, and watch the result; and yet this task has seemed to defy the efforts of as keen a body of inquirers as ever attacked any problem of Nature. If we look a little closer into the matter, we shall perhaps cease to wonder at the discordant conclusions which rival *savants* have deduced. We are too apt to forget that an

experiment may be as hard to perform as it is easy to enunciate. If we consider how much is involved in the direction to take dead matter, how much again in the requirement of absolute isolation, and how much more in the selection of conditions for life-evolution and the determination of the presence or absence of life at the close of the process, we shall begin to understand why so long a time and so much honest labor have been consumed without arriving at a final verdict. But everything points to a speedy conclusion. By a long course of patient work, controlled by eager criticism, the methods of procedure have been gradually perfected and simplified, the opposing ranks have closed, as it would seem, for their decisive struggle, the champions on either side have pressed to the front, and we may reasonably hope before long to see the final upshot of a controversy as old as scientific thought. At such an epoch it may not be uninteresting to glance at the salient points of the accumulated evidence, perhaps even to hazard a cautious forecast of the impending result.

In order to comprehend the positions of contending forces, it is always essential thoroughly to familiarize ourselves with the battle-ground which they occupy; and a somewhat closer survey of what we have termed the crucial experiment will be found not less essential to any intelligent appreciation of the position of this controversy. And first, what do we mean by dead matter? How is it possible to predicate with certainty the absence of life from anything on the face of the earth? The microscope has taught us that life in some shape or other abounds in almost everything about us. Either in active mobile vitality, or in the suspended animation of germinal existence, life teems in the soil we tread upon, in the water we drink, and, as some say, with equal abundance in the air we breathe. What worlds may exist as far beyond the range of microscopic vision as this surpasses the sphere of ordinary eyesight, no one can do more than guess. How, then, is the first requirement of our experiment to be satisfied? How is the prescribed specimen of dead matter to be got? This is the primary difficulty which investigators of this subject have had to grapple with. Happily it is not insurmountable. It is as certain as any fact in the whole range of science, that all living things and all living germs may be destroyed by the agency of heat. How much heat is needed to effect the destruction of life is still in question, but no one doubts that matter may be made absolutely dead by subjecting it to the influence of a sufficiently high temperature. The next condition — perfect isolation from surrounding life, whether active or germinal — has given more trouble, but can now be readily satisfied. All are agreed that no living germ can pass through a sound plate of glass; and a certain—perhaps in practice the only quite certain—method of isolation is to inclose the heated dead matter within a glass vessel hermetically sealed. Other less perfect means have been tried with various degrees of success. Many experimenters have found that the simple expedient of stuffing the narrow neck of a glass vessel with a plug of cotton-wool generally suffices to exclude the passage of living germs. Another method sometimes adopted is, to use for the experiment a flask with a long neck, so arranged that a portion of it can be kept at a high temperature, so as to burn out from the passing air every particle of living matter which it may contain. A third expedient, simpler than either of these, is to bend the open neck of the experimental flask alternately upward and downward, so as to form in each bend a receptacle into which the dust, dead or living, of the air will fall; and it has been said that this method may be relied on as surely protecting the interior of the flask from the approach of living germs, provided the subsidence is not interfered with by currents of air of too great vigor. Yet another method is to seal the open orifice of the flask by cementing over it a plate of earthenware, porous enough to admit air where that is desired, but of a texture so close as to bar the passage of the minutest germ.

All of these methods have been proved again and again to be more or less efficacious, but the only one the success of which can be predicated with absolute certainty is that which we first mentioned, though the last no doubt deserves to be trusted when practised with adequate care. When a glass vessel is hermetically closed we are able to say that its contents are isolated from everything outside which cannot pass through a film of glass. This barrier, it is known, suffices to stop the minute molecules of gas or vapor; and it is beyond doubt that it must exclude all grosser particles, including any living germs which may be supposed to be floating in the air. It was by adopting this process that Spallanzani in the last century turned the tide of opinion against Needham, whose results in support of spontaneous generation had been obtained by using a much clumsier method of excluding contamination; and it is not a little remarkable that after the superiority of this treatment had been so signally estab-

lished any subsequent investigators should have abandoned it in favor of a less exact mode of experimentation.

No maintainer of the theory of spontaneous generation would deserve a hearing if he refused to subject his experiments to the conclusive test afforded by a method which, with ordinary care, is known to be infallible; and germ-theorists would be fairly justified in rejecting all adverse experiments performed with no better safeguards than bent tubes or plugs of cotton-wool. The strange thing is that the severe condition of hermetically sealing has been self-imposed by Bastian and most other supporters of the *de novo* origin of life, while Pasteur, the great champion of the germ-theory, and many of his disciples (Tyndall among the rest), have generally been content to use less stringent methods. The consequences which have flowed from the extraordinary indulgence thus extended by these *savants* to their adversaries will be seen when we review a few of the most important series of experiments relied on upon either side. But for the present it is enough to note that neither of the first two fundamental conditions of the crucial experiment is beyond the resources of science. By applying sufficient heat dead matter may be obtained. By hermetically sealing the glass vessel which contains it the condition of perfect isolation may be secured.

The remaining steps in the investigation are comparatively free from difficulty. If the experiment is performed on suitable materials we know empirically under what conditions of temperature, concentration, and the like, life is most wont to appear, though absolute uniformity of result cannot always be predicted. Under some conditions it is found that life is invariably developed. Under other conditions it will frequently show itself. With yet other conditions its manifestation is extremely rare; while in others, again, its non-appearance may be almost certainly predicted. For the purpose of fully investigating the laws of life-evolution such limited knowledge as this would be far short of what is needed. But in order to solve the simpler question, whether life can, under any circumstances, arise without the presence of previously-living germs, it is amply sufficient. The last step of all in the inquiry was once supposed to present difficulties of the most serious kind. When one observer declared that he had found living things in a fluid which he had examined, it was quite a matter of course for his critics to suggest that what he had seen consisted of nothing but dead matter. It was not always easy to answer such objections, for the ordinary test of life is motion, and in the field of the microscope dead particles may simulate to some extent the movements of life. It is true that no observer of any experience could fail to discriminate between these Brownian movements, as they are called, and the active, darting motions of lively bacteria or monads; but still the doubt was so easy for an outside caviler to suggest, and it was so hard for a solitary worker to prove that he had not misinterpreted what he saw, that a haze of uncertainty was apt to rest on experiments dependent on such observations. Fortunately, this source of skepticism has been dried up. A much better test of life than motion is now almost always relied on—the power of multiplication. In all the experiments made with a view to try the truth of the rival theories we are considering, the particular form of life which is developed is that which accompanies ordinary putrefaction or fermentation, and it is now quite established that where putrefaction or fermentation is going on, life, in the shape of swarms of rapidly-multiplying bacteria, torulæ, or analogous organisms, may be assumed to be present. The question, in fact, has passed out of the range of the microscope. If a translucent organic fluid is seen to gradually grow turbid and putrefy, there is no need of a microscope to prove that the opalescent or turbid cloud is composed of a teeming mass of microscopic organisms. In doubtful cases of scarcely perceptible turbidity the microscope is often appealed to with success, and may always be used for confirmation. But in the great majority of cases the unassisted senses suffice to determine the presence or absence of life.

Enough has been said to demonstrate the feasibility of experiments decisive of the great issue raised in the cause of Spontaneous Generation *vs.* Germ Theory. It remains to consider how the balance of evidence inclines at present. Within the compass allotted to an article in these pages it would be impossible to discuss or even refer to a tithe of the experiments which have been performed with a view to elucidate the subject under consideration. A rather severely-restricted selection becomes a necessity, and it is very important that the selection should be governed by some fair and just principle. And the first consideration clearly ought to be given to the experiments which, from the conditions under which they were performed, are entitled to the greatest weight. The great bulk of scientific work is almost of necessity conducted in solitude or in the presence only of subordinate assistants, and

the all-prevailing rule is to accept as facts the announcements—not necessarily the inferences—of a scientific inquirer until his conclusions have been displaced by other investigators who have repeated his experiments with scrupulous accuracy, and have arrived at discordant results But though the work of an isolated individual must be *prima facie* accepted as trustworthy, it properly commands a far larger measure of confidence after it has been confirmed by others, and acquires the highest title to respect when it has been challenged and successfully repeated in the presence of an able opponent. In making our choice, therefore, of investigations to be specially described, we propose, whenever practicable, to put in the front rank those almost judicial experiments which have stood fire face to face with an adversary, and next in order to class those which have been successfully repeated by independent workers; resorting to what we may call solitary investigations in those cases only where no confirmed experiments exist, and paying but slight regard to mere general statement of results when the experimental details have not been furnished. Dealing in this way with the evidence on both sides, it may be practicable without exceeding due limits to present a fairly representative array of the most valuable materials for forming a rational estimate of the position of the controversy. It makes no great difference whether the work on one side or the other is brought first under review, but as the supporters of spontaneous generation maintain the assertion that, after complete destruction and exclusion of germs, life will sometimes display itself, while the case of the germ-theorists amounts to a simple denial of this proposition, the more convenient arrangement seems to be, first to weigh the evidence in support of the positive view, and then to set against it the negative testimony of its opponents. First, then, let us call Dr. Bastian into court, and, pursuing the course already indicated, the reader's attention shall be first directed to a remarkable series of experiments which he performed in concert with Dr. Burdon-Sanderson, then a resolute opponent, and then and now one of the very ablest investigators of this branch of biology.

But before quoting the details of the Bastian-Sanderson series of experiments, which we shall do from Dr. Sanderson's narrative published in *Nature*, on the 8th of July, 1873, a few words are needed to explain the circumstances out of which this special investigation grew. Dr. Bastian had published an account of a vast amount of work which he had done upon this subject during a continuous investigation of several years. The general nature of his experiments, so far as they related to the possibility of the *de novo* origination of life, was this: He took a small glass retort-shaped flask, partly filled with some infusion of organic matter, and drew out the tube of it to an almost capillary orifice. He then boiled the infusion for five minutes or more with sufficient activity to spurt out some of the contents at intervals, so as to wash the whole interior surface of the flask with the boiling liquid. Then, while the ebullition was still going on, he sealed the tube hermetically in a blowpipe-flame. The vacuum in the tube was tested as a safeguard against errors of manipulation, the flask was kept in a warm temperature, and the appearance or non-appearance of putrefaction and bacterial life was noted. These experiments were multiplied with a great number of different substances and with results by no means uniform. Some few infusions were found, as a rule, to remain clear and sterile after a long period of incubation. With other materials putrefaction occurred only in a moderate percentage of the specimens. Another class of infusions would always give a very large proportion of fertile examples together with a few that remained permanently sterile, while there were some specially favorable substances which never, or scarcely ever, failed to develop bacterial putrefaction within at most a few days. Sometimes, of two flasks of the same infusion treated, so far as could be ascertained, in precisely the same manner one would putrefy while the other remained pure, but in the course of his long series of investigations Dr. Bastian succeeded in discovering many of the conditions most favorable to the development of life. Although all the infusions employed, when once inoculated with the smallest drop of fluid containing bacteria, or in general when exposed to ordinary air, were certain in a brief period to become turbid, from their rapid multiplication, they were by no means equally prone to putrefy when boiled and protected in the sealed retorts. Urine, for example, though presumably as apt to engender life as any organic fluid that could be suggested, was for a long time thought by Bastian, as by his predecessors in the inquiry, to be absolutely proof against corruption if boiled and protected. Some meat-infusions offered less resistance to vital transformation, but still gave varying and sometimes small percentages of positive results. Others, again, such as hay and turnip infusions, yielded readily, though not invariably, to the putrefactive

change even when kept in moderate incubating temperatures; while there was one preparation, viz., a strong infusion of turnip with a little cheese-dust added, which was almost certain to develop life.

Not only did different substances behave thus differently, but for some inscrutable reason the very same infusion would often give negative results if diluted, when it seldom failed, if concentrated, to undergo putrefactive change with its regular accompaniment of bacterial life. By degrees, too, Dr. Bastian found out that infusions which remained sterile at such low incubating temperatures as 70° or 80° Fahr. would often yield to the more genial influence of greater warmth, and that even the most intractable would in some instances succumb to a temperature from 115° to 122°. The importance of this last element in the process was not as fully ascertained as it is now till after Dr. Sanderson's investigation, but recent experiments have shown that specimens of even so resistant a fluid as urine, when not too decidedly acid, are sometimes capable of producing life if kept, after boiling and sealing, in a bath at a temperature of 122°. No general rule can yet be laid down by which the behavior of any particular fluid may be certainly predicted from its constitution without actual trial, but Bastian's results agreed in the main with many older observations to the effect that neutral or very faintly alkaline fluids would putrefy after boiling and sealing more frequently and readily than acid infusions. Bastian has also made the further discovery that fertility might be prevented as much by excess of alkali as by excess of acid, and that some infusions were almost always sterile unless exact neutralization was secured. Notwithstanding this approach to a generalization, he obtained positive results in many instances from acid, from neutral, and from alkaline fluids. We may add that he found (as Spallanzani and other observers on both sides of the question had long before done) that with most fluids a great increase in the duration of the boiling was adverse to the subsequent evolution of life, sometimes retarding its appearance for many days, and sometimes preventing it altogether; though at the same time he ascertained that the action of other infusions was less easily interfered with, and that some would putrefy notwithstanding exposure to a boiling heat for one or more hours. Increase of temperature, and, according to some observers, even a small increase beyond the boiling-point, has also been proved to check life-development, although instances are recorded of putrefaction after exposure to such considerable temperatures as 110°, 125°, and even 150° C.

The discussion of the inferences to be drawn from cases of excessive or prolonged heating will be better deferred until we come to consider the whole mass of evidence on the question of the amount of heat required to destroy life in bacteria or their germs, if germs they have. At this stage we shall confine ourselves to cases where the temperature was that obtained by boiling maintained for a few minutes only.

When these experiments were published in 1871 and 1872, the scientific world naturally hesitated to accept them finally without confirmation, the more especially as they were of a kind that called for very careful manipulation, and pointed to a conclusion opposed to what was then the prevalent opinion on the subject. Among those who had expressed their doubts as to the accuracy of Bastian's work was Dr. Burdon-Sanderson. To set the matter at rest a series of fifteen flasks were operated upon in his presence according to Bastian's method.

Of these one was rejected in consequence of having become cracked, and of the remaining fourteen ten putrefied and produced bacteria and other forms of life, while four remained for several days, and perhaps, if not then broken for observation, would have remained permanently pure. Of the ten infusions which produced life, two were infusions of hay, one a strong infusion of turnip in its naturally acid state, two similar infusions of turnip neutralized with potash, two turnip with cheese, and three the same neutralized.

All the vigilance of an observer as acute and experienced as Dr. Sanderson failed to detect the slightest flaw in these experiments; and he frankly and publicly declared that he had been mistaken in his previous doubts, and that it was established to his satisfaction that infusions can be prepared which are not deprived, by an ebullition of from five to ten minutes, of the faculty of undergoing those chemical changes which are characterized by the presence of swarms of bacteria, and that the development of these organisms can proceed with the greatest activity in hermetically-sealed glass vessels from which almost the whole of the air has been expelled by boiling.

While this important test was being applied to Bastian's work, Profs. Huitzinga, of the University of Groningen, and Cohn, of Breslau, and other well-known *savants*, had been occupying themselves with similar investigations, and imme-

diately after the publication of Dr. Sanderson's notice Huitzinga[1] repeated the turnip and cheese experiments with the same result. After thus verifying Dr. Bastian's conclusions, Huitzinga made a fresh series of trials, in which the method was slightly varied. Instead of a turnip-infusion, he used a mixture of grape-sugar and soluble salts, and at the same time he substituted for the insoluble cheese-dust a small quantity of soluble peptone. He also employed different means for excluding the possibility of atmospheric contamination, and closed his flasks by cementing on them small disks of earthenware, instead of sealing them by heat. These alterations in the process made no difference in the result. Bacteria regularly appeared when the ingredients were used in certain definite proportions, which Huitzinga specified. But he added the very important observation that he could, by altering the proportions of the solutions, keep his fluids sterile, although in other respects treated exactly as before, and he justly relied on this differential process as proving that by his method any previously-existing germs in the liquid were destroyed and perfect isolation obtained; for the altered fluids were found as capable as ever of developing swarms of bacteria if once inoculated, though they remained barren when boiled and protected. More recently Prof. Cohn, of Breslau, whose name commands the highest confidence on this class of subjects not less in England than in his own country, has directed his attention minutely to this specific investigation, and he found[2] that hay-infusions, when acid, became fertile after boiling from periods ranging from fifteen to ninety minutes, while some similar infusions in the neutral state were not rendered sterile by boiling for two hours, although he inclined to account for the result on the hypothesis that the death-point had not been reached at the boiling temperature, a matter which will be discussed further on.

Such an accumulation of evidence as this would, of course, be overwhelming unless met by something like equivalent evidence on the other side; and before touching on any of the other facts or theories involved in the dispute, it will be well to see what the germ-theorists have to say on the single specific question whether it is possible, under any circumstances, for an organic infusion, with or without particles of solid matter in suspension, to putrefy after having been boiled and protected from contact with any germs or dust which may be contained in the air. They are not quite agreed as to the answer to be given. None of them deny, and most of them have expressly or implicitly admitted, that a turnip and cheese infusion will often produce bacteria under the specified conditions. Some of them still maintain that life never appears in any infusion so treated from which solid particles are excluded, while others limit their denial to acid infusions, and acknowledge that some neutral or slightly alkaline fluids will putrefy, notwithstanding previous boiling and adequate protection. How these various conclusions are interpreted by the different sections of the germ-theory school we shall consider further on. For the present we confine our attention to the simple question of fact. In marshaling the proofs on this side, we must give the first place to Pasteur, not only as due to his distinguished position, but because in order of time he preceded almost all of the modern inquirers, not excepting Bastian.

Pasteur operated for the most part upon a rather limited selection of fluids. His favorite medium was yeast-water sweetened in a certain definite way, which he used so frequently that it acquired the specific designation of "Pasteur's fluid." Nearly all his other experiments were made with milk, with urine, or with Pasteur's fluid, rendered neutral or faintly alkaline by the addition of carbonate of lime, the fluid in its original state being of an acid character. Urine, also, was of course acid, and milk somewhat alkaline. Pasteur's method of excluding contamination was, in general, by allowing the approach of air only through heated tubes, the more perfect plan of hermetically sealing having been rejected by him apparently from considerations of convenience. In some cases, also, he used plugs of cotton-wool or bent tubes for the same purpose of excluding air-dust, and he seems to have placed a reliance on these methods to which, in other hands, they have scarcely shown themselves entitled. He boiled his fluids from two to five minutes only, and used an incubating temperature of from 25° to 30° C. (77° to 86° Fahr.). The details of his principal investigation are given in the "Annales de Chimie," third series, volume lxiv., published in the year 1862.

The results obtained were that Pasteur's fluid and urine always remained sterile, while milk and the neutralized Pasteur's fluid always putrefied. He reversed these last results by superheating the alkaline fluids up to temperatures of from 100° to 110° C. (105° being the heat ordinarily employed), a circumstance which will deserve much

[1] *See Nature*, March 20, 1873.

[2] "Beiträge zur Biologie der Pflanzen," 1876, p. 259.

consideration when we come to the discussion of the bacterial death-point. There exists no very definite account of any confirmation of these experiments, but to a certain extent they were verified by Bastian and others as regards the temperature of 100° C., and they derive great weight from the acknowledged experimental skill of M. Pasteur.

The only other experiments to which we need refer, on the point now under consideration, are the very elaborate series conducted by Prof. Tyndall since the Bastian-Sanderson report. These, like Pasteur's, have not been precisely repeated, but Prof. Tyndall's position is such as to render a careful discussion, even of his isolated work, extremely interesting. It is, perhaps, to be inferred, from the emphasis with which Prof. Tyndall restricts his statements to purely liquid infusions, that he has gone over and confirmed Bastian's turnip and cheese experiments, but he did at one time (whatever he does now) maintain that no purely liquid infusion, whether acid or alkaline, could putrefy if boiled and protected from the contact of atmospheric dust. His experiments were conducted in two series, one described in a lecture at the Royal Institution early in 1876, published in a more mature form in the "Transactions of the Royal Society" for that year, and the other in a lecture delivered at the Royal Institution on the 19th of January in the present year, a report of which appeared in the *British Medical Journal* of January 27th. The general method employed was to cement a large number of test-tubes through the bottom of a box with their lower ends protruding, so as to admit of the application of heat. The box was closed and made air-tight, and a pipette provided for filling the tubes with such organic fluids as might be desired. The air within the box was, as the professor considered, absolutely purified from germs by subsidence, the interior of the box being coated with glycerine, to imprison whatever dust might fall upon it, and the completion of this process was determined by the use of the electric beam. A connection with the outer air was established through bent tubes and plugs of cotton-wool, which were thought to afford adequate protection against the intrusion of germinal matter. Why this roundabout and uncertain method of procedure was preferred to much simpler well-known means it is difficult to say; but in the first series of experiments it led to no catastrophe. Various infusions were inserted in the test-tubes by means of the pipette, which was carefully guarded against the passage of air otherwise than through wool. The tubes were heated for a few minutes by immersion in an oil-bath, and left in the laboratory to evolve life if they could. The temperature of incubation was not taken, but Prof. Tyndall stated afterward that a temperature of 90° Fahr. was "generally attainable" in the laboratory, and that on mild days and in favorable positions the temperature to which the infusions were subjected reached over 100°. All of them remained barren, including any neutral solutions among them, which, according to Pasteur, ought to have putrefied. In the present year the same experiment was repeated, at the Royal Institution, with the opposite result. Most of the infusions became putrid, in some instances more rapidly than what were intended to be precisely similar infusions exposed to the outside air. The experiment was repeated with an improved arrangement of the pipette, which had fallen under suspicion from the conduct of the infusions, but still with the same result. Then the incoming air was cleansed not only by the wool-filter, but by calcining it by means of red-hot platinum, but still with no change in the result. Another box was then experimented on at Kew, and this time the infusions remained pure with one exception, after having been kept for a time—not, we think, specified—in a temperature varying from 80° to a little over 90°, a degree of incubating heat not the most favorable, but which has very often been found sufficient to develop life. The conflicting results of these experiments were ingeniously accounted for by Prof. Tyndall—the failure at Kew being ascribed to a pin-hole, and those at the Royal Institution to the insufficiency of bent tubes, cotton-plugs, and red-hot platinum, to keep out or kill living germs at Albemarle Street, though they are still relied on as sufficient in a purer atmosphere, and were found so last year in the Royal Institution itself. The special theory resorted to to explain the contrast between the experiments at the Royal Institution in the two successive years is that in 1877 that atmosphere was charged with bacterial germs in such excess as to be proof against subsidence, burning, and plugging, and that this excess was due to the fact that in one of the rooms of the institution some old hay was to be found. How far this deserves consideration as a working hypothesis is a question which admits of difference of opinion; but Prof. Tyndall would scarcely ask us to accept it without proof as the real explanation. Why bacterial germs in excess should make their way through a sieve ordinarily close

enough to exclude them, is not apparent. Neither is it quite obvious why the red-hot platinum, which would burn up all the germs in ordinary air, should fail to do so when the contamination was excessive. And we are not quite sure that the subsidence of small particles from the air is at all hindered by increasing their number; and if it were, it would not be a very serious matter to an observer furnished, as Prof. Tyndall is, with an optical method of testing the purity of air so delicate as to determine the instant when the last particle of germinal or other matter has deposited itself. Even when these difficulties are got over, there is no warrant that we know of for assuming that old dry hay will fill the air with swarms of bacterium-germs. On the contrary, everything at present rather points to the hypothesis that desiccation would be fatal to bacteria and their germs, if they have any. No doubt it is true, as the professor pointed out, that hard, dry seeds will stand an amount of heat which would utterly destroy them when they were once soaked through. Many persons would probably be able to confirm his experience, that a very dry pea may be boiled for hours before the moisture penetrates its hard coating; and it is common knowledge now that a considerable amount of dry heat will not destroy the power of germination in seeds, which would yield at once to a moist temperature much below the boiling-point. Boiling a pea, therefore, seems a scarcely conclusive proof that bacterial germs, if there are any, can survive desiccation and induration, that they are freely given off in this protected state from old hay, and that when they get into the air they have a special power, not possessed by their moister brethren, of resisting subsidence, penetrating cotton-wool, and enduring the contact of air calcined by red-hot platinum. All this may be worked out some day, but it will need something more than boiled peas or dried seeds to establish it. The true inference to be drawn from the two series of experiments seems to be that the discrepancy has arisen from some cause which neither the public nor the professor himself have as yet any trustworthy means of so much as guessing at. The wise course would be to abandon for the future the unsatisfactory and complicated machinery employed in Prof. Tyndall's mode of experimentation, and to resort to simpler means of excluding atmospheric dust; and as to the conflicting experiments of 1876 to 1877, to let them drop quietly out of the argument until explained, the more especially as, in the case of neutral or slightly alkaline fluids, many of them contradict the orthodox germ-theorist, Pasteur, quite as emphatically as they do such heretics as Bastian and Huitzinga, to say nothing of the mysterious Dr. Sanderson, whom we dare not class either among the orthodox or the unbelievers, but who, whatever his theories may be, has borne manly testimony to the facts which he has observed.

A very much more important statement is contained in the paper in the "Philosophical Transactions of 1876," into which Prof. Tyndall expanded his lecture of that year. There it is distinctly, though briefly, alleged that Prof. Tyndall has repeated the Bastian-Sanderson process, and that with purely liquid infusions he found in multiplied experiments that they remained uniformly barren. His own explanation last year was that Dr. Bastian had allowed the gravest errors to invade his experimental work; that the life to which Dr. Sanderson testified, in the case of the purely liquid infusions, arose from errors of manipulation; and this year he adds that even the celebrated Prof. Cohn appears to have no adequate notion of the care necessary to be taken in experiments of this kind. To be consistent he ought to have attributed the same carelessness to Pasteur when he obtained life in boiled neutralized fluids, a feat which Prof. Tyndall declares impossible when due precautions are used; and perhaps in some degree even to himself, for overlooking the possible malignant influence of old hay. The worst of this kind of reasoning is not merely that it may be resorted to on one side as well as on the other, but that it tends to restore the habit of thought which once kept science dead for many centuries—the habit of appealing to authority in place of facts. Prof. Tyndall may or may not ultimately prove to be on the right side, but we crave some other reason for it than the mere assertion that his undoubtedly high authority as an experimentalist (backed by Pasteur as to part of his experiments and contradicted by him as to the rest) entitles him to treat with contempt the counter-authority of Bastian, Sanderson, Huitzinga, and Cohn.

At present the case stands thus: The same experiment has been performed by many competent and well-known men, and, strangely enough, with discordant results. Would not the natural solution to such a difficulty be for them to work, as Dr. Sanderson and Dr. Bastian did, together, and let the world know the result, rather than to hold aloof in barren self-assertion? This simple course would reveal at once the as yet undetected variations in manipulation which must lie at the root of discrepant results, and one necessary step

would be taken toward the settlement of the greatest problem which now divides the scientific world.

The evidence on the point which has hitherto been examined may be thus summed up:

1. It is established beyond dispute that a turnip-infusion, with cheese-dust added, will produce life after having been boiled and protected from contact with the atmosphere or anything it may contain.

2. The like fact has been ascertained by Huitzinga when soluble peptone was substituted for cheese-dust, and no counter-experiments on this point have ever been made public.

3. The like fact with reference to other purely liquid infusions has been alleged by Bastian, acknowledged after jealous scrutiny by Sanderson, confirmed by Huitzinga and Cohn, and (when the solution is not acid) by Pasteur, the chief of the germ-theory school. But Bastian's conclusions and Pasteur's conclusions are equally denied by Prof. Tyndall, mainly on the strength of his own unconfirmed experiments.

A theory was once started to the effect that the fertility of the turnip and cheese mixture might be due to the hypothetical fact that minute fragments of cheese-dust would protect any germs within them from attaining the temperature of boiling water during a period of five or ten minutes. To any one who ever boiled an egg this notion will seem too childish to need an answer; and, if there were anything in it, it would avail nothing for the germ-theorists until they had displaced Huitzinga's conclusion that soluble peptone will serve the purpose as well as cheese.

On the balance of evidence as it now stands there seems little to justify a doubt that organic substances, after being raised to 212° Fahr., will often produce life, though protected from all access of germs from without. But this proposition is very far from establishing the theory of spontaneous generation. To do so it is needful also to prove the further proposition that a moist temperature of 212° Fahr. is sufficient to destroy life, not only in bacteria but in any germs which they may throw off; and this is beyond question the most difficult part of the inquiry.

At the outset there is this puzzle: We know that bacteria ordinarily multiply by fission. We do not know whether they may not also multiply by germs. If they do, these germs are ultra-microscopic objects, though possibly discernible, *en masse*, by the aid of Tyndall's electric beam. It would seem to follow, therefore, that except from analogy we can know nothing about the qualities of such hypothetical germs, and are utterly unable to predicate what their powers of resisting heat may be. But science is not quite so helpless as this. When bacteria are clouding a fluid with their rapid increase, it may not unwarrantably be supposed that there are present the parents and their germs in every stage. If, therefore, we can find the temperature which will destroy the reproductive power of such a fluid, we may reasonably infer that we have discovered the heat which will kill or (what is absolutely the same thing for the purposes of our investigation) render inert any germs which they may be capable of engendering. But when this difficulty is surmounted there is yet another: What test can we apply to determine whether such death has been produced? If we place them in a suitable nutritive fluid, and the bacterial colony is found to increase and multiply, how are we to know whether the population is the offspring of germs undestroyed by the heat applied or the *de novo* product of the matrix fluid itself? Once assume as a starting-point the germ-theory, and the ascertainment of the death-point of bacterium germs is the simplest thing in the world. If life appears in the fluid inoculated with them, say at once that it is due to the germs, and that the heat was not enough to kill them. If, on the other hand, the fluid remains barren after the germs have been introduced, it follows that the heat was fatal. For the purpose of testing the validity of the germ-theory, it is obvious that no such *petitio principii* can be for a moment admitted; and yet, oddly enough, it was only by this deliciously *naïve* reasoning that Pasteur supported his view of the vital resistance of bacterial germs. He found that one or two acid fluids with which he worked would not putrefy after being heated to the boiling-point, and he inferred (so far legitimately enough) that no germ could (in such a fluid) sustain the temperature of 100° C. He also found that one or two neutral or faintly alkaline fluids would putrefy after boiling, though they failed to do so if heated to 110°, or even 105°. He thereupon straightway assumed that putrefaction could not come without germs, and therefore declared that germs heated in these non-acid fluids could survive a temperature of 100°, though they succumbed to a slightly greater heat. Of course this inference was idle while the germ-theory itself was in question, and some independent method of fixing the death-point remained to be discovered, if ever it was to be fixed at all.

If it were only possible to find a test-fluid

which never engendered life unless previously inoculated with breeding bacteria, and never failed to do so when it was so inoculated, the problem would be solved. We should then possess a reagent by which to test the existence of bacterial life, germinal or otherwise, as readily as arsenic or oxalic acid can be detected by the appropriate chemical tests. Fortunately there is no difficulty in finding fluids of this quality. There are solutions of chemical salts in which a drop of putrefying fluid will produce rapid and visible multiplication of bacteria, although the test-fluid, if left to itself and protected from contamination, will never engender them. Similar test-fluids may be produced by suitable treatment of some organic infusions, among them rather weak solutions of turnip and hay. Here, then, the test is furnished, and nothing is simpler than to ascertain the temperature which will destroy bacterial life. Take a mass of putrefying liquid in which bacteria are rapidly multiplying. Inoculate the test-fluid with a drop of the mixture—bacteria, germs and all—heat it to the required temperature, and see whether multiplication follows. If it becomes cloudy in a day or two, you are sure that the inoculating drop contained living bacteria or their germs, and that the heat applied was short of the death-point in the particular fluid used. If the test-fluid remains clear, it is equally certain that the heat has sufficed to kill all life, or, at any rate, all reproductive life, within it. The investigation was pursued in this way by Dr. Bastian.[1] The results are very remarkable. They show that when the fluid employed, whether a saline solution, an acid turnip, or neutral hay infusion, was heated above 158° Fahr., the bacteria and germs within it absolutely lost the power of multiplication; while, if heated only to 130°, they always retained vitality. The precise heat which produced sterility in different fluids varied between these limits, but 158° was found to be the maximum temperature which a growing and multiplying swarm of bacteria, with their families and their germs, could in any of these cases survive.

These experiments have never, so far as we know, been repeated. They cannot, therefore, rank with confirmed investigations; but of course no germ-theorist who has not gone over the same ground with inconsistent results can be heard to dispute their accuracy. Outside inquirers may legitimately reserve their unqualified acceptance until the work has been repeated, and the conclusions confirmed by independent investigators; but in the mean time it must be acknowledged, at least as a *prima-facie* truth, that in certain turnip and hay infusions, no less than in solutions of mineral salts, a temperature of 54° short of the boiling-point is sufficient to destroy the life of bacteria and any germs of bacteria.

Coupling this conclusion with the results before discussed of the experiments on boiled and protected fluids, the spontaneous-generation theory would follow as a mere matter of logic. If all reproductive life in a putrefying hay or turnip infusion is killed by a temperature of 158°, and yet another infusion of the same substances (differing only in strength and in some particulars of treatment) can produce life after being boiled and protected from contamination, that life must have come from something other than germs, or, in other words, must have arisen *de novo*. Still it is prudent to bear in mind that observations which have remained for a year or two unquestioned may be disputed and possibly displaced; and, however irresistible the *ad-hominem* arguments may be against opponents who have not ventured to grapple with these death-point experiments, the final verdict of Science will not be given, and ought not to be given, without further confirmation, or until full time has been allowed for some champion of the germ-theory to enter the lists and combat experimental conclusions which, while they stand, are fatal to his creed.

As has been already indicated, some approach to such a struggle has been recently made. It has taken the form, not indeed of a direct impeachment of the specific results last referred to, but still of a definite issue which involves to a certain extent the same question. The challenger in this instance is Pasteur himself, the Achilles of his host. His opponent we need scarcely say is Bastian, the acknowledged chief of the opposing faction. And the precise dispute is this: It had long been recognized on both sides that heating, and especially prolonged heating, beyond the boiling-point, had a strong tendency to check subsequent putrefaction; and the germ-theorists very fairly made a great point of this. It was an obviously natural inference that if an infusion would vivify after exposure to a temperature of 100°, and failed to do so if the previous heating were carried up to 105°, 110°, 120°, or 150°, as was found to be the case in various fluids, the positive results obtained with the lower temperature were due to the survival of germs, while the negative results, often brought about by severer heating, showed that in those cases the death-point had been reached. The explanation offered

[1] "Evolution and the Origin of Life," pp. 79–129.

by the supporters of spontaneous generation was at first sight much less attractive. They said that the modifying effect of superheating had nothing to do with the destruction of germs, which were dead long before the boiling-point was reached, and that it ought to be ascribed to disintegrating changes, set up by the high temperature, of such a character as to indispose the fluid for vital transformation. If Bastian's death-point experiments should be finally established, this last view must be accepted as the only doctrine which is compatible with them; but the germ-theorists, though they have not yet attempted to displace the results of that investigation (as for the sake of settling a knotty scientific question it is to be hoped they will soon muster courage to do), have held firmly to their old notion, and Pasteur especially has reiterated of late the formula which he propounded in 1862, that germs are killed in acid fluids at 100° C., while neutral or faintly alkaline fluids exercise a protective influence during the heating which enables any germs within them to endure a temperature of a few degrees more. Even in these fluids he maintained, and still maintains, that all germs are certainly deprived of life or of fecundity—the only practicable test of life—by a temperature of 110°. An example of an undoubted fact pointing in this direction is afforded by the behavior of urine, which is, in its normal state, an acid fluid. If boiled in its natural condition for a very few minutes and then protected, it seldom (until quite recently it was thought never) evolves bacterial life. If it has first been rendered neutral, or about neutral, by the addition of an alkali before boiling, it is now known often to prove fertile. Pasteur's theory would ascribe this to his assumed fact that germs can bear a higher temperature in neutral than in acid fluids.

All that was needed in this case to test the truth of Pasteur's doctrine about the protective power of neutral fluids was to boil the urine in its acid state, which, according to Pasteur himself, would kill all previously-existing germs, and then add the alkali afterward, and see if it would not be equally efficacious in promoting the evolution of life. If it proved so, there would be an end of Pasteur's plausible theory on the point. Accordingly, Bastian devised a very pretty arrangement for testing the question. He placed in one of his retorts a measured quantity of urine of ascertained acidity; he then prepared a small tube, into which he poured a quantity of liquor potassæ, somewhat less than enough to neutralize the urine. The proportion which he found to give the best results was about three-fourths of the neutralizing dose. Having done this, he sealed the small tube in the blowpipe, drawing out the end sufficiently to cause it to break readily with a smart tap. The potash-tube thus prepared was heated for a long time, varying from fifteen minutes to two hours, in water which was kept boiling with the object of destroying any life, if life there could be, in the liquor potassæ and the air within the tube. After this the tube was dropped with its thinned end downward, gently into the retort, which was then boiled and hermetically sealed in the usual way. After cooling, the retort was briskly shaken, so as to break the point of the small tube and allow the contained fluid to mix with and neutralize the urine. A number of retorts thus prepared were placed in a bath kept at a high incubating temperature, about 122°, together with one (or sometimes more) in which the potash-tube was left unbroken, as a control-experiment. After a day or two, or even less, the contents of the retorts which had been neutralized almost invariably putrefied just as it was known they would have done if the alkali had been added before the boiling, while the still acid urine in the control-flask remained permanently barren. It followed that the vivifying influence of the alkali was due to some chemical or other molecular action, and not to its supposed power of warding off heat, and the experiment, coupled with the universally-accepted fact that all germs perish in urine boiled in its natural state, left apparently no alternative but to accept the conclusion that life had appeared *de novo* in the neutralized fluid. We may mention that the reduction above mentioned in the quantity of the liquor potassæ below the neutralizing proportion was at first adopted empirically, and it was supposed to be needed only to compensate for the loss of part of the contents of the retorts during the process of boiling. Another and probably more potent reason is, that the urine may undergo changes which reduce its acidity not only while exposed to boiling heat, but at a slower rate during the whole time that it remains in the more moderate temperature of the incubating bath. There seems, however, no present reason to doubt that exact neutralization is the state in which putrefaction most readily occurs, and, to insure that, it is safer to keep the supply of liquor potassæ below than above the mark, because in the former case the acidity would gradually come down to the neutral point, while anything like an excess of alkali has been

found as fatal as an excess of acid to the production of life.

This experiment was no sooner communicated to the French Academy than Pasteur, who had held aloof from the controversy for many years, rushed again into the fray. He repeated Bastian's experiment, and confirmed his observation. But he did not yet give up his theory. Instead of that, he tendered the only explanation open to him, and said that the life proceeded from germs left unkilled in the liquor-potassæ tube, though kept at a boiling heat for a long time. He repeated the experiment with some alterations, the principal one being the use of pure solid potash in place of liquor potassæ. This time he obtained no life, which Bastian attributed to an excessive dose of alkali. Ultimately, after a lively correspondence, the French *savant* challenged our countryman to repeat his experiment with this variation, that the potash-tube should be heated either for twenty minutes to 110° C., or for five minutes to 130°. The next issue of the "Comptes Rendus" contained a letter from Bastian stating that he had done what Pasteur required in the way of heating, and more, having kept his potash-tubes at 110° C. for twenty hours instead of twenty minutes, and that he obtained just the same results as before. This brought from Pasteur a letter in English to the *Lancet*, vehemently asserting that such results were impossible; and by a strange oversight, for which the translator is, we hope, solely responsible, declaring that though Bastian can undoubtedly succeed in his experiment with a temperature of 100°, he has done nothing but repeat Pasteur's own old experiment, and confirm his theory, announced fifteen years ago, that the sterilization of organic fluids, when they are neutral or slightly alkaline, requires a temperature higher than 100° C. It is odd that the writer or the translator should not have appreciated the crucial distinction between neutralizing the fluid for protection of live germs before the boiling and neutralizing it afterward, when on the common hypothesis the germs were already dead. But angry men sometimes are a little blind. In conclusion, he announces that the Academy have at his request appointed a commission composed of MM. Dumas, Milne-Edwards, and Boussingault, to investigate the matter, and condoles with his opponent on his approaching condemnation.

With abundant chivalry our countryman instantly accepted the challenge, and offered to repeat his experiments in the presence of the commission, provided that a satisfactory programme should be arranged beforehand to insure him a fair opportunity of presenting and proving his case. Those who remember the history of a former French commission on the very same subject, on which two of the present commissioners served, may be excused for doubting whether the guarantees for a fair and open investigation which were refused to MM. Pouchet, Joly, and Musset, will be conceded to an Englishman who presumes to question the infallibility of Pasteur. The three French *savants* who then disputed Pasteur's views were placed under such restrictions by the course of procedure laid down for them by the commissioners that they considered it due to their dignity to retire. The abortive commission ended, as it is likely this will end, in an *ex-parte* hearing. It is possible, indeed, that MM. Dumas and Milne-Edwards may think that more generosity is due to a foreigner who ventures to appear before a tribunal from which every one who inclines to his side of the controversy has been eliminated. If they are disposed to allow of a fair preliminary programme, and to concede the guarantee of publicity, it is conceivable that an interesting investigation may result; but if it is really desired to obtain a verdict which will carry weight elsewhere than in Paris, it would be well to add to the distinguished *savants* already nominated some who are less committed to Pasteur's views and less dazzled by the glamour of his great reputation. We doubt much whether Pasteur would, even with the strongest guarantees, consent to appear before three English believers in spontaneous generation. It is much to be regretted that these vexed questions of fact have not long before this been submitted to an impartial English tribunal. There are competent men enough for the purpose on each side, and, what is still better, there are to be found able scientific men, versed in this kind of investigation, who have committed themselves to neither view, and have maintained an attitude of philosophical reserve. With such materials at hand, backed by our English love of fair play, it would be very hard if we could not produce at home a better and fairer tribunal than that which M. Pasteur has proposed. Is not the comity of Science capable of bringing about some such arrangement?

—*Contemporary Review.*

NARROWING THE EXPERIMENTAL ISSUE.[1]

EVERY one interested in the subject of spontaneous generation will remember that Prof. Tyndall made, last year, a series of ingenious experiments in which he adopted the method of subsidence for purifying the air to which his putrescible infusions were exposed—that is to say, he placed the infusion in chambers washed on the inside with glycerine, and, before commencing the experiment, allowed the air to settle until a beam from the electric lamp revealed no motes in it. By these means all putrefactive germs falling on the bottom and sides of the chamber were caught by the glycerine, and infusions of various sorts—animal and vegetable—could be kept in the chamber for any length of time without showing the slightest tendency to putrefy. A similar set of experiments has recently been made by the Rev. W. H. Dallinger, who, operating with the germs of known organisms, has been able to show the rate at which these living motes fall through the air, and the time after the expiration of which putrescible fluids, in a still atmosphere, are out of danger from their contact.

When a maceration fluid—such as an infusion of fish in water—is allowed to dry up, it forms a "light, hard, porous, papier-mâché-like mass," in which are contained, in incalculable millions, the germs of those organisms to which the putrefaction of the fluid was due. A cake of this sort was taken, derived from a fluid known to contain the germs of two forms of monad, the life-history of which Mr. Dallinger had worked out, namely, the "calycine monad" and the "springing monad." A small quantity of the powder from this cake was dried at 150° Fahr., a temperature 15° above that required to kill the adult form, and was then diffused through the air of a Tyndall's chamber. In this chamber were placed vessels containing a putrescible fluid, some open, some covered with lids which could, by a simple mechanical contrivance, be removed without disturbing anything else. Twenty-four hours after the exposure of the open basins to the mote-laden atmosphere, the covers of the others were removed, and everything was left for a certain time, after which first the open and subsequently the remaining basins were examined. It was then found that in those which had been exposed to the air from the first the calycine monad occurred in every drop taken from every vessel, and the springing monad in two-thirds of the drops examined. In the vessels which had not been exposed until the air had settled for twenty-four hours, the calycine form was wholly absent in three vessels out of four, and in the others occurred only in four drops out of thirty, while the springing form flourished in every vessel.

The reason of these facts is very curious and very interesting. The calycine monad is a giant of its kind, being about $\frac{1}{900}$ inch in length, while the springing monad is not longer than $\frac{1}{3000}$ inch. The germs of these naturally bear some proportion to the size of their parents, and, consequently, the minute particles of protoplasm which constitute the spores of the calycine monad were some ten times as heavy as those of the other, and had nearly all fallen and impregnated the fluid in the open basins before the covered vessels were exposed. Mr. Dallinger put the matter to a further test. There is one monad, the "uninflagellate" form, upon which many of his observations had been made; this in its adult state is about $\frac{1}{4000}$ or $\frac{1}{4800}$ inch in length, and its spores are so small as actually to be invisible with the highest powers of the microscope. Dust from a dried cake containing these spores was mixed with some containing the comparatively gigantic calycine form, and the former experiment repeated. It was found that nearly all the "calycine" germs had fallen in twenty-four hours, all in forty-two hours, for vessels exposed after the lapse of the last-named time contained not a single calycine monad, while every drop taken from them swarmed with the little uninflagellate form.

Mr. Dallinger has thus shown most conclusively that whenever a putrid infusion dries up there will be found a powdery mass containing spores which every breath of air will diffuse far and wide, and that some of these spores are so minute as to require two days to fall a few inches in a perfectly still atmosphere, so that the distance to which they could be carried, and to which they could spread contagion, is practically unlimited. The bearing of this on the germ-theory is obvious enough.

Some months since, the spontaneous-generation controversy arrived at an important crisis. Results of the most conflicting character had been

[1] From "Recent Science" in the *Nineteenth Century*, revised by Prof. Huxley.

obtained by different observers, and a settlement of the question seemed further off than ever. But, about the middle of last year, Dr. Bastian earned the gratitude of biologists by narrowing the point at issue, and giving, for a time at least, a definite direction to future experiments. He announced, at the meeting of the Royal Society on the 15th of June,[1] that he had discovered the precise conditions under which living organisms were infallibly produced in certain putrescible but sterilized organic fluids. If this supposed discovery were a real one, its importance could hardly be over-estimated; for if once the conditions requisite for development of life *de novo* in an organic fluid were ascertained, it would be but one step further to imitate those conditions in a manufactured fluid of known composition, and thus to gain some conception of the way in which the first germs of life may have originated on the earth. The theory of evolution would thus be complete at one end of the scale of being, and would receive a confirmation of its truth which "none of our enemies would be able to gainsay or to resist."

The needful conditions for the spontaneous development of life in boiled organic fluids are, according to Dr. Bastian, the neutrality or slight alkalinity of the fluid, or its maintenance at a tolerably high temperature (115°–120° Fahr.). He placed his putrescible fluid (urine) in glass retorts, into the necks of which he introduced a small sealed glass tube drawn out to a fine point and containing enough potash solution to neutralize the fluid, the potash having been previously heated to the temperature of boiling water. After the introduction of the potash-tube the retort and its contents were subjected for some minutes to the boiling temperature; the neck of the vessel was sealed during ebullition, and, after cooling, the potash was liberated by a shake sufficiently violent to break the capillary tube.

Under these circumstances Dr. Bastian found that in every case the fluid swarmed with bacteria after a longer or shorter time; while no organisms were developed if it remained acid, or if an excess of alkali had been added. Even under these latter circumstances, however, a copious development of bacteria was insured by keeping the fluid at a temperature of 122°.

This is Dr. Bastian's case. But it will be observed that he failed to "mak sicker" in two important points: in the first place, there was no proof that the fluids in question would not have developed bacteria without the addition of the potash; and, secondly, the potash was heated only to the temperature of boiling water, a temperature which, though amply sufficient to kill adult bacteria, has been proved, in many cases, to leave their germs unslain. It became essential, then, to repeat the experiments, allowing the fluids to stand sufficiently long, before adding potash, to make it tolerably certain that no organisms would be developed without the addition of the alkali, and to heat the potash to a temperature considerably above the boiling-point of water, so as to insure the complete destruction of the most enduring microphyte-germs.

Experiments with these necessary precautions have lately been made by Prof. Tyndall, and Dr. W. Roberts, of Manchester, and their results seem to demonstrate, conclusively enough, the fallacy of Dr. Bastian's conclusions.

Dr. Roberts's experiments[1] were conducted in the same manner as Dr. Bastian's, with one or two important modifications. In the first place, the tube containing the proper quantity of potash for neutralization of the fluid was heated, in an oil-bath, to a temperature of 280° Fahr., 68° above the boiling-point of water; secondly, after the flask containing the boiled fluid with its contained potash-tube had been hermetically sealed —of course during ebullition—it was allowed to stand in a warm place for a fortnight, and thus prove its complete sterility. The potash-tube was then broken, and the flask exposed to a temperature of 115°, and afterward to one of 122°; that is, the fluid was exposed to the very conditions which, according to Dr. Bastian, are most potent in inducing spontaneous generation. Nevertheless, every one of the flasks was found to be absolutely sterile. It must be observed that not one of the essential conditions was altered—potash is no more affected by the temperature of 280° than by that of 212°; the putrescible fluid was only boiled, under the ordinary atmospheric pressure, for five minutes, so that its composition could have been in no way altered, and yet the results obtained were, without exception, negative.

In Prof. Tyndall's[2] experiments the same course was adopted, except for the fact that the potash was heated only to 220° Fahr. instead of 280°. Again the results were negative. Prof. Tyndall, as usual, brings forward a "cloud of witnesses" to prove his position, and says, "The experiments have already extended to one hun-

[1] "Proceedings of the Royal Society," 1876, vol. xxv., No. 172.

[1] *Proceedings of the Royal Society*, vol. xxv., No. 176.

[2] *Loc. cit.*, p. 457.

dred and five instances, not one of which shows the least countenance to the doctrine of spontaneous generation."

Similar results have been obtained in France by M. Pasteur, and once more there seemed to be some promise of a settlement of the difficulty, when Dr. Bastian communicated to the French Academy the results of further experiments, in which he had heated his potash to a temperature above that prescribed by his opponents and for a longer time, and, under these circumstances, he always obtained a copious development of bacteria.

Thus, then, the matter now stands with regard to this particular experiment, and the question seems to have become one of experimental ability between the upholders of the two opposing views. There are, however, certain facts recently brought forward by Prof. Tyndall, which throw a very important light upon the possible cause of such extraordinary discrepancies.

It is a well-known fact that dried peas resist the action of boiling water for a much longer time than green peas—that, in fact, the latter are reduced to a pulp in a space of time hardly sufficient to soften the former. Prof. Tyndall [1] found that an infusion of old hay was much more difficult to sterilize than one of fresh hay, and that, while a few minutes' boiling sufficed to kill all germs in the latter, those contained in hay a year or two old resisted the action of heat for a very long time. He naturally concluded from this that the almost infinitely minute germs of microphytes may, in just the same manner as peas, become dried and hardened, and so able to oppose a long and obstinate resistance to the action of heat.

Assuming, then, as it seems one is bound to do, that germs may and do undergo this excessive induration, one is able to form some conception of the difficulty of sterilizing a fluid in which, as is certainly the case in very many instances, such veteran germs occur, and to appreciate the ingenuity with which Prof. Tyndall has overcome the difficulty. He finds [1] that frequent applications of a low degree of heat, applied at intervals, have a far greater sterilizing effect than a single application of a very high temperature.

A given fluid may contain germs of all ages. If this fluid is boiled for a considerable period, all those of recent formation will be killed at once, while those of considerable age will only be just sufficiently softened to enable them to germinate subsequently. If, on the other hand, the fluid is first heated for a short time—and a fraction of a second is often sufficient—the recent germs will be killed, and those a degree older so softened, that, after a period of latency, they are ready to germinate. Heat now applied for a short time will kill these, and fit a third set for growth; and the same course may be adopted for successive crops, until even the hardest and driest germ is killed. It was found that a fluid which was not rendered barren by boiling for an hour was completely sterilized by this process, although never heated up to the boiling-point, and although the whole time of heating did not amount to five minutes; and even the infusions which had given Prof. Tyndall most trouble were, without exception, rendered permanently barren.

[1] "Preliminary Note on the Development of Organisms in Organic Infusions."—*Proceedings of the Royal Society*, vol. xxv., No. 177.

[1] "On Heat as a Germicide when discontinuously applied." Read before the Royal Society in February.

A MODERN "SYMPOSIUM."

THE INFLUENCE UPON MORALITY OF A DECLINE IN RELIGIOUS BELIEF.

DR. WARD.—I agree with the Dean of St. Paul's, that the wording of our question is unfortunately ambiguous; and I think that this fact has made the discussion in several respects less pointed and less otherwise interesting than it might have been.

For my present purpose, I understand the term "religious belief" as including essentially belief in a personal God and in personal immortality. Less than this is not worthy the name of religious belief; and, on the other hand, I will not refer to any other religious truths than these. I am to inquire, therefore, what would be the influence on morality of a decline in these two beliefs.

But next, what is meant by "morality?" I will explain, as clearly as brevity may permit, what I should myself understand by the term; though I am, of course, well aware that this is by no means the sense in which Sir J. Fitzjames Stephen, or Mr. Harrison, or Prof. Clifford, understands it.

I consider that there is a certain authoritative rule of life,[1] necessarily not contingently existing, which may be regarded under a twofold aspect. It declares that certain acts (exterior or interior) are intrinsically and necessarily evil; it declares, again, that some certain act (exterior or interior), even where not actually evil, is by intrinsic necessity, under the circumstances of some given moment, less morally excellent than some certain other act. Any given man, therefore, more effectively practises "morality," in proportion as he more energetically, predominantly, and successfully aims at adjusting his whole conduct, interior and exterior, by this authoritative rule. Accordingly, when I am asked what is the bearing of some particular influence on morality, I understand myself to be asked how far such influence affects for good or evil the prevalence of that practical habit which I have just described; how far such influence disposes men (or the contrary) to adjust their conduct by this authoritative rule.

These explanations having been premised, my answer to the proposed question is this: The absence of religious belief—of a belief in a personal God and personal immortality—does not simply *injure* morality, but, if the disbelievers carry their view out consistently, utterly *destroys* it. I affirm—which, of course, requires proof, though I have no space here to give it—that no one except a theist can, in consistency, recognize the necessarily existing authoritative rule of which I have spoken. But for practical purposes there is no need of this affirmation, because in what follows I shall refer to no other opponents of religion, except that antitheistic body—consisting of agnostics, positivists, and the like—which in England just now heads the speculative irreligious movement. Now, it is manifest on the very surface of philosophical literature that, as *a matter of fact*, these men deny in theory the existence of any such necessary authoritative rule as that on which I have dwelt. A large proportion of theists accept it, and call it "the Natural Law;"[1] an agnostic or positivist denies its existence. It is very clear that he who denies that there is such a thing as a necessarily existing authoritative rule of life cannot consistently aim at adjusting any, even the smallest, part of his conduct by the intimations of that rule; or, in other words, cannot consistently do so much as one act which (on the theory which I follow) can be called morally good.

Here, however, a most important explanation must be made. It continually happens that some given philosopher holds some given doctrine speculatively and theoretically, while he holds the precisely contradictory doctrine implicitly and unconsciously; insomuch that it is the latter, and not the former, which he applies to his estimate of events as they successively arise. Now the existence of the Natural Law—so I would most confidently maintain—is a truth so firmly rooted by God himself in the conviction of every reasonable creature, that practically to leaven the human mind with belief of its contradictory is, even under the circumstances most favorable to that purpose, a slow and up-hill process. In the early stages, therefore, of antitheistic persuasion, there is a vast gulf between the antitheist's speculative theory and his practical realization of that theory. Mr. Mallock has set forth this fact, I think, with admirable force, in an article contributed by him to the *Contemporary* of last January. When antitheists say—such is his argument—that the pursuit of truth is a "sacred," "heroic," "noble" exercise—when they call one way of living mean, and base, and hateful, and another way of living great, and blessed, and admirable[2]—they are guilty of most flagrant inconsistency. They therein use language and conceive thoughts which are utterly at variance with their own speculative theory. If it be admitted (1) that the idea expressed by the term "moral goodness" is a simple idea, an idea incapable of analysis; and (2) that to this idea there corresponds a necessary objective reality *in rerum natura*—if these two propositions be admitted, the existence of the Natural Law is a truth which irresistibly results from the admission. On the other hand, if these two propositions be *not* postulated, then to talk of one human act being

[1] To prevent misapprehension I may explain that, in my view, those various necessary truths which collectively constitute this rule are, like all other necessary truths, founded on the essence of God: they are what they are because he is what he is.

[1] The Natural Law more strictly includes only God's *prohibition* of acts intrinsically evil, and his *preception* of acts which cannot be omitted *without* doing what is intrinsically evil. But we may with obvious propriety so extend the term as to include under it God's *counseling* of those acts which, as clothed in their full circumstances, are by intrinsic necessity the more morally excellent.

[2] Pp. 177, 178.

"higher" or "nobler" than another is as simply unmeaning as to talk of a bed being nobler than a chair, or a plough than a harrow. Whether it be the bed, or the plough, or the human act, it may be more *useful* than the other article with which it is brought into comparison; but to speak in either case of "nobleness" is as the sound of a tinkling cymbal. Or rather, which is my present point, the fact of antitheists using such language shows that their practical belief is so far essentially opposed and (as I, of course, should say) immeasurably superior to their speculative theory. To my mind there is hardly any truth which needs more to be insisted on than this, in the present crisis of philosophical thought: when antitheism successfully conceals its hideous deformity from its own votaries, by dressing itself up in the very garments of that rival creed which it derides as imbecile and obsolete. I heartily wish I had space for setting forth in full and clear light the argument on which I would here insist. I may refer, however, to Mr. Mallock's article, for an excellent exposition of it from his own point of view; and, in particular, I cannot express too strongly my concurrence with the following remarks:

"All the moral feelings" (he says) "at present afloat in the world depend, as I have already shown, on the primary doctrines of religion; but that the former would *outlive* the latter is nothing more than we should naturally expect: just as water may go on boiling after it is taken off the fire, as flowers keep their scent and color after we have plucked them, or as a tree whose roots have been cut may yet put out green leaves for one spring more. But a time must come when all this will be over, and when the true effects of what has been done will begin to show themselves. Nor can there be any reason brought forward to show why, if the creed of unbelief was once fully assented to by the world, all morality—a thing always attended by some pain and struggle — would not gradually wither away, and give place to a more or less successful seeking after pleasure, no matter of what kind."

I would also recall to Sir J. Fitzjames Stephen's remembrance an admirable statement of his, which occurred in the work on "Liberty, Equality, and Fraternity." "We cannot judge of the effects of atheism," he says, "from the conduct of persons who have been educated as believers in God, and in the midst of a nation which believes in God. If we should ever see a generation of men, especially a generation of Englishmen, to whom the word 'God' has no meaning at all, we should get a light on the subject which might be lurid enough."[1]

So far I have used the word "morality" in that sense which I account the true one. But a different acceptation of the word is very common; and it will be better perhaps briefly to consider our proposed question in the sense which that acceptation would give it. Morality, then, is often spoken of as consisting in a man's sacrifice of his personal desires for the public good; so that each man more faithfully practises "morality" in proportion as he more effectively postpones private interests to public ones. I have always been extremely surprised that any theist can use this terminology; though I am well aware, of course, that many do so. To mention no other of its defects, it excludes from the sphere of morality precisely what a theist must consider the most noble and elevating branch thereof, viz., men's duties to their Creator. Constant remembrance of God's presence, prayer to him for moral strength, purging the heart from any such worldly attachment as may interfere with his sovereignty over the affections—these, and a hundred others, which are man's highest moral actions, are excluded by this strange terminology from being moral actions at all. Still, in one respect there is great agreement between the two "moralities" in question, for under either of them morality very largely consists in self-denial and self-sacrifice.

Now, if it be asked in what way morality, as so understood, would be affected by the absence of religious belief, I think the true reply is one which has so often been drawn out that I need do no more than indicate it. Firstly, apart from theistic motives there is no sufficient moral leverage; men would not have the moral strength required for sustained self-denial and self-sacrifice. Secondly and more importantly, if theistic sanctions were away, no theory could be drawn out explaining why it should be *reasonable* that a man sacrifice his personal interest to that of his fellows.

On this matter I am glad that I have the opportunity of drawing attention to a very fine passage of Mr. Goldwin Smith's, published in the *Macmillan* of last January:

"Materialism has, in fact, already begun to show its effects on human conduct and on society. They may perhaps be more visible in communities where social conduct depends greatly on individual conviction and motive than in communities which are more ruled by tradition and bound together

[1] Second edition, p. 326.

by strong class organizations; though the decay of morality will perhaps be more complete and disastrous in the latter than in the former. God and future retribution being out of the question, it is difficult to see what can restrain the selfishness of an ordinary man, and induce him, in the absence of actual coercion, to sacrifice his personal desires to the public good. The service of humanity is the sentiment of a refined mind conversant with history; within no calculable time is it likely to overrule the passions and direct the conduct of the mass. And after all, without God or spirit, what is 'humanity?' One school of science reckons a hundred and fifty different species of man. What is the bond of unity between all these species, and wherein consists the obligation to mutual love and help? A zealous servant of science told Agassiz that the age of real civilization would have begun when you could go out and shoot a man for scientific purposes; and in the controversy respecting the Jamaica massacre we had proof enough that the ascendency of science and a strong sense of human brotherhood might be very different things. 'Apparent diræ facies.' We begin to perceive, looming through the mist, the lineaments of an epoch of selfishness compressed by a government of force."

In fact, even in the present early stage of the English antitheistic philosophy, if its adherents are directly asked what is man's reasonable rule of life, I know of no other answer they will theoretically give except one. They will say that any given person's one reasonable pursuit on earth is to aim at his own earthly happiness—to obtain for himself out of life the greatest amount he can of gratification. No doubt they will make confident statements on the indissoluble connection between happiness and "virtue." Still, according to their speculative theory, the only reasonable ground for practising "virtue" is its conduciveness to the agent's happiness.

Now, let us suppose a generation to grow up, profoundly imbued with this principle, carrying it consistently into detail, emancipated from the unconscious influence of (what I must be allowed to call) a more respectable creed. What would be the result? Evidently a man so trained, in calculating for himself the balance of pleasure and pain, will give no credit on the former side to such gratifications as might arise from consciousness of conquest over his lower nature, or from the pursuit of lofty and generous aims. These, I say, will have no place in his list of pleasures: because he will have duly learned his lesson, that there is no "lower" or "higher" nature; that no one aim can be "loftier" than any other; that there is nothing more admirable in generosity than in selfishness. On the other hand, neither will he include, under his catalogue of *pains*, any feeling of remorse for evil committed, or any dread of possible punishment in some future life; for he will look with simple contempt on those doctrines, which are required as the foundation for such pains. His commonsense course will be to make this world as comfortable a place as he can, by bringing every possible prudential calculation to bear on his purpose. Before all things, he will keep his digestion in good order. He will keep at arm's-length (indeed at many arms'-lengths) every disquieting consideration, such, e. g., as might arise from a remembrance of other men's misery, or from a thought of that repulsive spectre which the superstitious call moral obligation.

It is plain that duly to pursue the subject thus opened would carry me indefinitely beyond my limits;[1] and I will only, therefore, make one concluding observation. If the term "virtue" be retained by those of whom I am speaking, it will be used, I suppose, to express any habitual practice which solidly conduces to the agent's balance of earthly enjoyment. I am confident that—should this be the recognized terminology, and should the new school be permitted to arrive at its legitimate development—there is one habit which would be very prominent among its catalogue of "virtues." The habit to which I refer is indulgence in licentiousness — licentiousness practised, no doubt, prudently, discreetly, calculatingly, but at the same time habitually, perseveringly, and with keen zest.

PROF. HUXLEY.—We are led to do this thing, and to avoid that, partly by instinct and partly by conscious motives; and our conduct is said to be moral or the reverse, partly on the ground of its effects upon other beings, partly upon that of its operation upon ourselves.

Social morality relates to that course of action which tends to increase the happiness or diminish the misery of other beings; personal morality relates to that which has the like effect upon ourselves.

If this be so, the foundation of morality must needs lie in the constitution of Nature, and must depend on the mental construction of ourselves and of other sentient beings.

The constitution of man remaining what it is, his capacity for the pleasures and pains afforded by sense, by sympathy, or by the contemplation

[1] I have treated it at somewhat greater length in an article which I contributed to the *Dublin Review* of last January, pp. 15–21.

of moral beauty and ugliness, is obviously in no way affected by the abbreviation or the prolongation of his conscious life; nor by the mere existence or non-existence of anything not included in Nature; nor, so long as he believes that actions have consequences, does it matter to him what connection there may be between these actions and other phenomena of Nature.

The assertion that morality is in any way dependent upon the views respecting certain philosophical problems a person may chance to hold, produces the same effect upon my mind as if one should say that a man's vision depends on his theory of light; or that he has no business to be sure that ginger is hot in the mouth unless he has formed definite views, in the first place, as to the nature of ginger, and, secondly, as to whether he has or has not a sensitive soul.

Social morality belongs to the realm of inductive and deductive investigation. Given a society of human beings under certain circumstances: and the question whether a particular action on the part of one of the members of that society will tend to the increase of the general happiness or not is a question of natural knowledge, and, as such, is a perfectly legitimate subject of scientific inquiry. And the morality or immorality of the action will depend upon the answer which the question receives.

If it can be shown, by observation or experiment, that theft, murder, and adultery, do not tend to diminish the happiness of society, then, in the absence of any but natural knowledge, they are not social immoralities.

It does not follow, however, that they might not be personal immoralities. Without committing myself to any theory of the origin of the moral sense, or even as to the existence of any such special sense, I may suggest that it is quite conceivable that discords and harmonies may affect the congeries of feelings to which we give the name, as they do others.

I see no reason for doubting that the beauty of holiness and the ugliness of sin are, to a great many minds, no mere metaphors, but feelings as real and as intense as those with which the beauty or ugliness of form or color fills the artist-mind, and that they are as independent of intellectual beliefs, and even of education, as are all the true æsthetic powers and impulses.

On the other hand, I do not doubt the existence of persons, like the hero of the "Fatal Boots," devoid of any sense of moral beauty or ugliness, and for them personal morality has no existence. They may offend, but they cannot sin; they may be sorry for having stolen or murdered, because society punishes them for their social immoralities, but they are incapable of repentance.

Before going further, I think it may be needful to discriminate between religion and theology.

I object to the very general use of the terms religion and theology, as if they were synonymous, or indeed had anything whatever to do with one another. Religion is the affair of the affections, theology of the intellect. The religious man loves an ideal perfection, which may be natural or non-natural; the theologian expounds the attributes of what he terms "supernatural" Being as so many scientific truths, the consequences of which work into the general scheme of Nature, and are there discernible by ordinary methods of investigation. What the theologian affirms may be put in this way: that beyond the *natura naturata*, mirrored or made by the natural operations of the human mind, there is a *natura naturans*, sufficient knowledge of which is attainable only through the channel of revelation.

Now, I think it cannot be doubted that both religion and theology, as thus defined, have exercised, and must exercise, a profound influence on morality. For it may be that the object of a man's religion—the ideal which he worships—is an ideal of sensual enjoyment, or of domination, or of the development of all his faculties toward perfection, or of self-annihilation, or of benevolence; and his personal morality will, in part, contribute largely to the formation of his ideal, and will, in part, be swayed and bent until it harmonizes with that ideal.

Moreover, it is clear that a man's theology may give him such views of the action of the *natura naturans* as will profoundly modify or even reverse his social morality.

He may see ground for believing that conduct of evil effect upon society, which is part of the *natura naturata*, is in harmony with the laws of action of the *natura naturans;* and that, as the rewards and punishments of men are but slight and temporary, while those inflicted by the greater power behind the *natura naturata* are grievous and endless, common prudence may dictate obedience to the stronger. And history proves that there is no social crime that man can commit which has not been dictated by theology and committed on theological grounds. On the other hand, the belief that the divine commands are identical with the laws of social morality has lent infinite strength to the latter in all ages.

In like manner it seems to me impossible to over-estimate the influence of speculative beliefs

as to the nature of the Deity, apart from all idea of rewards and punishments, upon personal morality. The lover of moral beauty, struggling through a world full of sorrow and sin, is surely as much the stronger for believing that sooner or later a vision of perfect peace and goodness will burst upon him, as the toiler up a mountain for the belief that beyond crag and snow lie home and rest. For the other side of the picture, who shall exaggerate the deadly influence on personal morality of those theologies which have represented the Deity as vainglorious, irritable, and revengeful—as a sort of pedantic drill-sergeant of mankind, to whom no valor, no long-tried loyalty, could atone for the misplacement of a button of the uniform, or the misunderstanding of a paragraph of the "regulations and instructions?"

While no one can dare history, or even look about him, without admitting the enormous influence of theology on morality, it would perhaps be hard to say whether it has been greater or less than the influence of morality on theology. But the latter topic is not at present under discussion; and the only further remark I would venture to add is this—that the intensity and reality of the action of theological beliefs upon morality are precisely measured by the conviction of those who hold them that they are true. That such and such a doctrine conduces to morality, and disbelief in it to immorality, may be demonstrated by an endless array of convincing syllogisms; but, unless the doctrine is true, the practical result of this expenditure of logic is not apparent. I have not the slightest doubt that if mankind could be got to believe that every socially immoral act would be instantly followed by three months' severe toothache, such acts would soon cease to be perpetrated. It would be a faith charged with most beneficent works, but unfortunately this faith can so easily be shown to be disaccordant with fact that it is not worth while to become its prophet.

For my part I do not for one moment admit that morality is not strong enough to hold its own. But if it is demonstrated to me that I am wrong, and that without this or that theological dogma the human race will lapse into bipedal cattle, more brutal than the beasts by the measure of their greater cleverness, my next question is to ask for the proof of the truth of the dogma.

If this proof is forthcoming, it is my conviction that no drowning sailor ever clutched a hen-coop more tenaciously than mankind will hold by such dogma, whatever it may be. But if not, then I verily believe that the human race will go its evil way; and my only consolation lies in the reflection that, however bad our posterity may become, so long as they hold by the plain rule of not pretending to believe what they have no reason to believe because it may be to their advantage so to pretend, they will not have reached the lowest depths of immorality.

MR. R. H. HUTTON.—That has happened to us which happened to the disputants in that Attic Symposium from which, I suppose, the name for our discussion was taken. We have been interrupted by a "great knocking at the door" and the entrance of an unbidden guest, who, however, shows no sign either of Alcibiades's intoxication, or of that generous disposition to crown the most deserving with garlands which may perhaps have had some connection with the excesses of the brilliant Athenian's potations. The *Saturday Reviewer*, who, without dropping his mask, has thrust upon us his own criticism on our discussion,[1] has certainly not conferred the most meagre of wreaths on any one, unless indeed it may be said that he grudgingly crowns the Dean of St. Paul's and the Duke of Argyll with a withered sprig or two of parsley, for pointing out that our subject is much too vague, and for trying to narrow a discussion so "abstract and ill-defined." His general criticism is contained in the harsh remark that "all the fine talk of the chosen *illuminati* is a mass of words with very little meaning," and that the deliberations of the Symposium bear a very strong resemblance to those of the diplomatists who have been lately concocting protocols; that is, they consist of empty phrases to which all the parties can agree because they do not touch any of the points on which the co-signataries would be likely to differ." That is a much crueler interruption than any caused by Alcibiades to the guests assembled at the Symposium of Plato, nor do I think it is quite just, though there is enough justice in it to make me try to bring out what seem to me the clearly-understood issues between us a little more distinctly, in the few words I have to say. To limit the subject as much as possible, I will speak of nothing but the effect likely to be produced on morality by any decline in the belief in a righteous God independent of, and external to, the human race—in one, that is, whose leading purpose in relation to us is believed to be to mould our motives and characters into the likeness of his own. Now it seems to me that all

[1] *See Saturday Review* for March 31st, article "A Modern Symposium."

the previous speakers except two, Mr. Frederic Harrison and Prof. Clifford, believe, for different reasons, and in different degrees, that such a decline in such a belief in God would probably result in a parallel decline in human morality; though some insist most, like Sir James Stephen and Prof. Huxley, on the point that any attempt to bolster up the belief artificially *for the sake* of its moral consequences, by discountenancing free discussion, would result in a worse decline of morality, and others insist most, like Dr. Martineau, Lord Selborne, and Dean Church, on the point that the same causes which result in a decline in this belief (especially as it is represented in Christianity) are likely to result also in a decline in the force of the ethical principles so closely associated with it. But I do not understand any one to differ with Prof. Huxley, that if the belief can be shown to be false, be the moral consequence what it may, it ought to go. On the other hand, I understand both Mr. Harrison and Prof. Clifford to assert that the causes which, as they think, have undermined and are undermining the belief in a righteous God, external to the human race, have no tendency to undermine the binding power of the highest human ethics, but, on the contrary, have a direct tendency to elevate and refine them, though Prof. Clifford regards this tendency as, on the whole, slight, and confined chiefly to the blow which such a change in belief will have in diminishing the control of the clergy, while Mr. Harrison expects very much indeed from it, if only through its tendency to concentrate on the desirable aims of a real world, an enthusiasm now so much dissipated in his opinion, by lavishing it on imaginary objects.

Now, while I heartily admit with Prof. Huxley the conceivability that a gross delusion—like the belief that "every socially immoral act would instantly be followed by three months' severe toothache"—if it could be palmed off successfully upon our race, would have *some* very beneficial consequences—(some also by no means beneficial)—and should not a bit the less regard a conspiracy, even if one were practicable, to impose such a delusion on our race, as a great sin, I cannot the more on that account see how to disentangle the question whether there be a righteous God external to men from the question whether there would be a great moral loss to human nature in the dissipation of the belief in such a God. It is quite conceivable—nay, it has often happened—that a sincere delusion has produced the best results. The belief in an imaginary danger of death, for instance, has often made a man take life more seriously; and the belief in an imaginary danger of invasion has probably often bound a divided nation together and given it a greater nervous strength and manliness. But though it is easy to conceive a belief, in some respects beneficial, which is wholly false, it seems to me, in the case before us, that the very element in the belief we are discussing, which makes it beneficial, is also a clear note of its truth. What makes the belief in such a God as I have spoken of beneficial is that this belief, and this only, gives to the attitude of man's mind, in relation to right motive and right action, that mixture of courage and cheerful irresponsibility for the result characteristic of a *faith*. Luther's great saying, "We say to our Lord God that if he will have his Church, he must uphold it, for we cannot uphold it, and, even if we could, we should become the proudest asses under heaven,"[1] would be of course simply untranslatable into any humanist or positivist dialect at all. I do not indeed quite know what Mr. Harrison means when he talks of a "frankly human" religion which shall provide us with a "Providence" whom we are "to love and serve;" but I suppose he must mean that we are to love that law of the universe which produces a certain amount of correspondence between our nature and its "environment," and that we are to coöperate with that law. At least this is the only meaning I am able to attach to "loving and serving" a Providence without believing in God. Now for myself I am incapable of loving a mere law of any kind, whether it be a law of gravitation, a law of assimilation between my organism and its environment, or any other; and as for "serving" it, I like to judge for myself, and, instead of allowing myself always to be assimilated to my "environment," I sometimes prefer what is called, in the language of the same philosophy, "differentiating" myself from it. But I think even Mr. Harrison would hardly justify language of trust like Luther's, toward a "Being" of whom we are supposed to know nothing except that it has given rise to the earth we live on, and will most likely, in a few thousand years, also put a final end to it. You cannot trust a being of whose purposes, or capacity for having purposes, you know nothing, because trust implies approving those purposes and believing them to be accompanied by a far higher range of knowledge and foresight than your own. Yet has not all the benefit of trust in God arisen from that humility

[1] "Tischreden," edition Förstemann, Leipsic, 1844, vol. ii., p. 330.

and courage, that self-abandonment to a higher will, that sense of complete irresponsibility for the result when the right thing is once done, which constitute moral heroism? Could such moral heroism survive the belief in a divine will which is shaping all right action to a perfect end? Suppose we believed in unknown causes which produce indeed such moral phenomena as those of human life for a moment in the long ages of evolution—which bring them like a ripple to the surface, but quench them, like that ripple, for evermore, and which are as certain so to quench them as the sun is one day to be burned out—is it possible we could cast ourselves on such unknown causes with the sort of faith in God that has "moved mountains," and that will move mountains again, that will say, for instance, to this huge dead weight of secularism and positivism, "Be thou cast into the sea," and it will obey?

Nor can I see any better help in Prof. Clifford's substitute for God—namely, the higher self represented by "the voice of our Father Man who is within us," i. e., by "the accumulated instinct of the race poured into each one of us" and overflowing us, "as if the ocean were poured into a cup." The "accumulated instinct of our race" includes a great deal of evil as well as good, and is often unaccompanied by any accumulation of instinct for the suppressing of the evil by the good. I quite agree with those who have urged that it was the "accumulated instinct" of the Athenian people which taught them the necessity of putting down Socrates as one who was undermining the social order to which he belonged. I do not doubt that Socrates shared that accumulated instinct not less—nay, probably, much more—than the rest of his countrymen. Probably it overflowed him "as an ocean might overflow a cup." Nevertheless the solitary voice within him, which he attributed to his "dæmon," though it could not drown the voice of this "accumulated instinct," was heard above it, and prevailed over the pleas of comradeship, and over what Prof. Clifford deems the only "spring of virtuous action," the impulse which invites men to make individual sacrifices to promote the greater efficiency of the social bond.

"Some one may wonder (says Socrates, in Plato's 'Apology') why I go about in private giving advice and busying myself with the concerns of others, but do not venture to come forward in public and advise the state. I will tell you the reason of this. You have often heard me speak of an oracle or sign which comes to me, and is the divinity which Meletus ridicules in the indictment. This sign I have had ever since I was a child. The sign is a voice which comes to me and always forbids me to do something which I am going to do, but never commands me to do anything, and this is what stands in the way of my being a politician. And rightly, as I think. For I am certain, O men of Athens, that if I had engaged in politics I should have perished long ago, and done no good either to you or to myself. And don't be afraid of my telling you the truth, for the truth is that no man who goes to war with you or any other multitude, honestly struggling against the commission of unrighteousness and wrong in the state, will save his life; he who will really fight for the right, if he would live even for a little while, must have a private station and not a public one."[1]

This is unsocial doctrine enough, and, of course, Prof. Clifford will say that, though fatal to the existing Athenian state, it had its source in instincts essential to a higher political virtue and to the cohesion of a nobler kind of state. Grant it for a moment. Yet how can we expect moral heroism of the same type as that which is convinced that invisible Power is on its side, and trusts to the vindication of the future, if instead of ascribing the origin of its impulses to a divine Power which is the same yesterday, to-day, and forever—a Power above it and beyond it—he who has to evince this moral heroism believes that there is no inspiring mind higher than his own, and holds, therefore, that he must rely on himself, and on himself alone, for the fine faculty to discriminate between the inchoate order of a new society and the worn-out guarantees of an order which is passing away? How is one who is fully aware that he is dissolving the ancient bonds of a venerable society and polity, but who only *hopes* that he is creating the germs of something better, to set his face against the brotherhood among whom he lives, and to defy the wrath of the fellow-citizens whom he sees, and all without the whisper of approval from any spiritual being behind the veil? Surely the hesitating inspiration of that long-buried ancestor, "our Father Man"—to admit, for a moment, Prof. Clifford's assumption—when it spells out dubious and unaccustomed lessons which the voices of our brother-men join, in loud chorus, to decry, would not be very likely to triumph over fears and scruples which "our Father Man" also authenticates, and authenticates much more positively than he ever can authenticate the first faintly-uttered principles of a new kind of social

[1] Prof. Jowett's "Plato," vol. i., p. 346, first edition.

union against the old. What was it, as I asked before, which stimulated Luther to his gigantic enterprise? Not the doubtful guess that buried generations had transmitted to him the glimpse of a reform which would transfigure society, but the belief that he could honestly use the language of that psalm that he so much delighted to appropriate to himself: "They came about me like bees, and are extinct even as the fire among the thorns, for in the name of the Lord I will destroy them." Whether the belief in "our Father Man" and in a tentative Providence which does not *foresee*, but only accommodates the individual to his "environment," as the only guides of our moral life, be wild or sober, this, I think, is clear, that it does not provide the martyr or the reformer with the stimulating power of a *faith;* that it can give no confidence like that in an inspiration of far wider grasp and far deeper purpose than any which the reformer himself commands; that it leaves him a mere *pioneer* amid dangers and difficulties to which it may turn out that both he and his race are quite unequal, instead of a humble follower obeying the beckoning of one who holds both past and future in his hand.

And now as to my second point—that the very element which gives so beneficial a character to the belief that conscience is the inspiration of God—the very element which makes it a useful and practically stimulating belief, and not, as Prof. Clifford calls it, a mere source of "refined and elevated pleasure"—is also a note of its *truth*. I hold this to be so because the very experience which produces the trust is an experience of life, and of life morally higher than one's self. Surely, if we are competent, as we are, to say when our friends and our favorite books tempt us, and when they raise us above temptation, we are also competent to say when thoughts that strike with a living power upon the heart come from a higher and when they come from a lower source than that of our own habitual principles of action—when they come with promise and command, and when they come with discordant sneers, discouragement, and enervation. When we grasp dimly at a great moral principle which is full, to use Prof. Tyndall's language, of "the promise and potency" of all forms of life—when the more we consider it, the less we see where it is leading us, and yet only feel the more confidence in it on that account—when we recognize a clew and a guide without recognizing where that clew and that guide are pointing to—when we know that it is our duty to defy the world in the name of a principle of which we cannot gauge the full meaning, or measure even the immediate effects (and this is, as I maintain, the true phenomenon visible in all great moral, as in all great intellectual, origination)—then it does seem to me to be a sober and wholesome conviction that that which *we* do not know, there is one who puts the clew into our hands, who does know; that what we cannot foresee, there is one who does foresee; that we are grasping the hand of a Power which knows the way before as well as behind; that we are following the glimmer of a ray which will lead us on to the dayspring from which it descended. I cannot but believe that we have as secure a faculty to discriminate the superiority of the life in which a moral impression originates as we have to discriminate its rightness itself—that it is one and the same act of discrimination which says, "This is obligatory," and which says, "This is instinct with divine life and promise." To suppose that a dead ancestry are flashing through us these commands which at once repudiate their principles and nerve us against the wrath of their descendants, seems to me, I confess, a degrading superstition. If "we boast to be better than our fathers," it must be some one better than our fathers who is giving us our watchword. This is why I hold that to lose the faith in God would be to lose a great inheritance of moral order and moral progress, and also to lose at the same moment a truth in comparison with which all other truths are as dim and isolated sparks beside a pillar of fire that can guide us through a wilderness that we have never even explored.

SIR JAMES STEPHEN.—The paper which began this discussion was entitled "The Influence upon Morality of a Decline in Religious Belief." The Dean of St. Paul's remarks: "It seems to me difficult to discuss this question till it is settled, at least generally, what morality is influenced, and what religious belief is declining." The Duke of Argyll observes that these papers "deal with a question very abstract and ill-defined." Dr. Ward says that "the wording of our question is unfortunately ambiguous, and I think that this fact has made the discussion in several respects less pointed and less otherwise interesting than it might have been."

To these criticisms I reply that the title of my paper contains no question at all, and was not intended to do so. It is simply an indication, in the most general terms, of the subject to which the paper of which it is the title relates. Any one who will take the trouble to read the paper

will see that its principal object was to assert the proposition with which it concludes, which is in these words:

"This [i. e., the whole of the preceding argument] shows that the support which an existing creed gives to an existing system of morals is irrelevant to its truth, and that the question whether a given system of morals is good or bad cannot be fully determined until after the determination of the question whether the theology on which it rests is true or false. The morality is [I should have said "may be"] good if it is founded on a true estimate of the consequences of human actions. But if it is founded on a false theology it is founded on a false estimate of the consequences of human actions; and, so far as that is the case, it cannot be good; and the circumstance that it is supported by the theology to which it refers is an argument against, and not in favor of, that theology."

The only "question" which my paper was intended to raise is the question whether that proposition is true or not? I do not see how its truth can depend (as the Dean of St. Paul's suggests) upon further particulars as to "what morality is influenced," or "what theology is declining." I said nothing about the decline of any particular theological belief, or its influence on any particular system of morals. My proposition would apply to all creeds and all forms of morality.

As to the Duke of Argyll's statement that "the question is very abstract and ill-defined," I should admit its justice if the title of the paper were taken as the statement of a question. But this is not the case. The proposition which I put forward, in the hope that it would be discussed, is no doubt general in its terms, but it seemed, and still seems to me, definite enough to be discussed. As to the "ambiguity" of which Dr. Ward complains, I cannot see how my proposition can have more meanings than one.

The papers which have been written subsequently to my paper raise a great variety of points which I feel much tempted to discuss, but I hardly feel at liberty to do so, as they do not in any way qualify anything said by me. Each paper, indeed, is an illustration of the truth of some part of my proposition or of the assertions by which it is introduced; for each shows in various ways how very close is the connection in the writer's mind between the theological system which he believes to be true and the moral system which he considers to be good; and this, again, shows that the question of truth must precede the question of goodness, and cannot be determined by any answer which may be given to the latter question. I cannot help thinking that if this were understood generally it would affect very deeply the character of a great proportion of current theological speculation.—*Nineteenth Century.*

RICHARD WAGNER.

By H. R. HAWEIS.

I.

WAGNER is the most powerful personality that has appeared in the world of music since Beethoven. But indeed he seems to me, in his wide range as poet, dramatist, musician, and philosopher, almost alone in the history of Art.

Beethoven was a musician only. His glory is to have carried the art of music to its extreme limits of development: no one has yet gone beyond him.

Wagner says, "I have invented nothing." You cannot invent metre after the Greeks, or the modern drama after Shakespeare, or coloring and perspective after the Italians—there is a point at which an art ceases to grow and stands full-blown like a flower.

Most people admit that in music, as in other arts, that point has been reached. What, then, remained? *This*, according to Richard Wagner: to concentrate into one dazzling focus all the arts, and, having sounded and developed the expressional depth, and determined the peculiar function of each, to combine them at length into one perfect and indivisible whole.

Words seem childishly inadequate to render all at once such a conception as this. Slowly we may master some of its details and allow them to orb into a perfect whole. If you stand at the foot of one of the Alps, you can see but a little

portion of it—a hamlet, a sloping patch of vineyard, and a pine-copse beyond: but as you ascend the winding path the prospect opens to right and left; cascades leap by to lose themselves in the torrent below—you plunge into the gloom of a forest and emerge on to the higher meadows and pleasant scenes of pastoral life—yonder the soil grows rocky, and tumbled bowlders lie around you—the cloud lifts, and a vista of mountains and valleys is suddenly opened up, and pressing forward you leave far below the murmurs of one world, and raise your enraptured eyes to the black eagle, as he wheels aloft in the golden air beyond the stainless and eternal snows.

So when we are brought face to face with such a varied, complex, and immense intelligence as that of Richard Wagner, we are apt to dwell on a part—a peculiarity of the music—a turn of the drama—a melody, a situation, an eccentricity. But the secret lies, after all, in the unity of effect. Close your eyes after a day in the Alps, and, as the visions pass before you, all will grow clear to your inner consciousness, and the varied scenes you have realized only in succession will at last arrange themselves into one great and majestic whole.

II.

"PERHAPS he has some talent for music," said the sick man as he heard little Richard, then only seven years old, strumming a tune from "Der Freischütz" on the piano. It was Louis Geyer, his step-father, painter, author, and actor, now on his death-bed, thinking of the future, planning as dying men plan, and hitting the mark as they often hit it, quite at random. The child's vivid temperament and eager, sensitive mind had always made him a favorite with the actor and the poet, and he thought of making a painter of Richard, but the boy seemed to have no turn for it. His mother, a woman full of life and imagination, was less anxious and more wise. She let him grow, and happily he was left to her, "with no education," as he says, "but life, art, and myself."

Indeed, any attempt to hasten Wagner's development, or to fix his career, would doubtless have failed. From the first, the consciousness of his own force has been one of his strangest and strongest peculiarities. At times it seems to have almost intoxicated him—at others it sustained and cheered him in utter loneliness; it has dominated all who have come in personal contact with him, and bent the minds and wills of the rebellious like reeds before the wind.

And the reason is evident. Wagner was always prodigious in his ability. Like those very fast trotters that flash along the highways of England and America, he has been in the habit of passing every one on the road, and passing them easily. But the consciousness of power bred in him a singular willfulness. At school he could learn anything, but he would learn only as he chose and what he chose. When *his* time came he mastered, with incredible rapidity and accuracy, Greek, Latin, mythology, and ancient history. As for his music-master, he soon sent him to the right about, telling him he would learn music his own way. Indeed, the variety of influences, and the rapidity with which he absorbed them, one after the other, quite unfitted him for going into harness early in any one direction.

At the age of seventeen he had dipped into most literatures, ancient and modern—glanced at science, learned English in order to read Shakespeare, weighed several schools of philosophy, studied and dismissed the contending theologies, absorbed Schiller and worshiped Goethe (then eighty-four years old), turned away from the conventional stage of Kotzebue and Iffland, tasted politics, and been deeply stirred by the music of Beethoven.

There was doubtless a great indistinctness about his aims at this time. To live, to grow, to feel, to be filled with new emotions, and to sound his enormous capacities for receiving impressions and acquiring facts — this had hitherto been enough; but the vexed question was inevitable: to what end?

The artistic temperament could give but one answer to that—"EXPRESSION!" Creation itself—man—the world, the universe—is nothing but that. There is ever this imperious divine necessity for outward expression. This is the lesson of the ages and of the universe—of which we see but a little speck realized upon our tiny and overcrowded planet. But this burning thought turns the mind of man itself into a divine microcosm—he, too, begins to obey in his higher activities what he perceives to be the supreme law of the divine life. He, too, must flash into self-consciousness, and breathe in form, until all that slept in the silence of his heart comes forth swift and radiant with the wind and fire of emotion, and stands at last like an angel, full of wreathed melodies and crowned with stars.

Such to the artist-soul is the beloved parable of earth. The life within must become outward; all that we are is dying to be born, is craving to realize itself, to know, to possess, to adore! Is man social? His being passes by an organic law

into the expression of family life. Is he political? He creates the state. Is he thoughtful and imaginative? He evolves literature, science, and the arts. Is he spiritual? His soul passes into the religions of the world.

It is quite obvious that life is here seized, not from the intellectual, but from the emotional side. The intellect is used to fathom, to formulate, to economize, and represent, in their most impressive forms, the feelings which would otherwise be wasted and misspent; but the intellect, which has played so important a part in Wagner's system, is always the second, never the first factor, and its function has been to analyze the various expressional media of the past and present, and to create some form or combination more exhaustive and powerful than all the rest.

Wagner was willing to be led. But he could not help feeling that an artist now is the heir of all the ages, that now for the first time he can stand and gauge the creations of the past in poetry, painting, drama, and music, and ask himself how far, through these, has the inner world of the mind found utterance. Wagner had the unconscious but inflexible hardihood to take up each art in turn, weigh it, and find it wanting. Each fell short of the whole reality in some respect. Painting leaves out motion and solidarity, sculpture possesses solidarity without motion, and usually without color. Poetry without drama appeals to the senses chiefly through the imagination; in itself it has neither sound, color, nor solidarity. The spoken drama lacks the intensity which it is the unique function of musical sound to give; while mere pantomime, whether of dance or drama, lacks the indefinite power of sound as well as the definite suggestion of words; and, lastly, musical sound alone provokes the eternal "why?" which can only be answered by associating the emotion raised with thought, for music alone is without solidarity, color, or thought, while possessing motion and sound in the highest perfection.

It will be said, "Yes, but each art is complete in itself." True, but not complete as a means of expressing thought and feeling. You urge: "But the power of art lies often in its suggestiveness. I read a poem and shut my eyes, and the vision is more splendid than anything that could be presented outwardly." Yes, indirectly, because you have imagination; the vision was beautiful, but its quality depended on *you*, not on the *art*. Art is for expression, and that art is best which expresses most. Do not confuse the effects of imagination and association with the effects of art. A barrel organ or a daub may serve to set agoing imagination and memory, but art has to do with expression, and is defective *quâ* art just where it begins to make these demands upon imagination and memory.

Those who have traced Wagner's career from boyhood know how patiently he has questioned every art how passionately he has surrendered himself to it, for a time; how willing he would have been to rest, how inexorably experience and feeling have urged him on until, like the hardy navigators of old, he broke at last into a new and undiscovered ocean.

At the age of eleven he had read Shakespeare. Surely dramatic expression of thought and feeling could go no further. But he would test it as a form of art by experiment, and see how it worked. He immediately constructed a drama, horrible and thorough—a cross between "Hamlet" and "King Lear." Forty-two characters suffered death in the first four acts, so that in the fifth, in order to people his stage at all, most of them had to reappear as ghosts. The Shakespearean method was closely adhered to, and for several years he continued to brood over it lovingly.

Here was a form intensely individual, self-conscious—in which man explored the depths of his own nature. On that rough wooden stage of the Globe Theatre so vivid were the characters, so rapid and complex the feelings, so perfect and expressive the pantomime, that the want of stage-trappings and accessories was hardly felt. Still it was a restrained expression; it was too mosaic; the individuals lacked a universal element in which to live and move and have their being: we sit fascinated and bewildered with the subtile analysis and changing episodes; but the characters do not run up into universal types, they are too entirely absorbed by their own thoughts and feelings. The contest here is not with Fate and Time, as on the Greek stage, but with self and society.

Excited but oppressed by the complex inner life of the Shakespearean drama, Wagner still felt the need of wedding the personal life to some larger ideal types, and intensifying the emotional element by the introduction of musical sound. Then the cramped wooden stage of the Globe Theatre vanished, and in its place rose the marble amphitheatre, open to the sky, imbedded in the southern slope of the Athenian Acropolis.

In the classical drama nothing was individual —the whole life of Greece was there, but all was summed up in large and simple types. The act-

ors speak through fixed masks. All fine inflection is lost; all change of facial expression sacrificed to massive groupings and stately poses, regulated by the shrill pipe and the meagre harp. But still there is in the dramas of Æschylus, Euripides, and Sophocles, a breadth of expression which enables the soul to shake itself free from its accidental surroundings and enter into general sympathy with the wider life of humanity. It is this escape into the ideal which the modern self-conscious spirit most needs: this merging of discordant self in the universal harmony which drew Wagner toward the theatre of the Greeks. There we start from the gods, the ideal representatives of human thought and emotion. Zeus is in Agamemnon, Ares in Achilles, Artemis in Iphigenia, Aphrodite in Phædra; and there is something prophetic and sublime in the spontaneous growth of these types beneath the human touch until they transcend the gods and conquer Olympus itself. Cassandra is greater than the gods in her consciousness of injustice; Prometheus is sublime in his godlike defiance of Fate; Antigone triumphs through voluntary sacrifice—it is the inexorable progress of the human conscience toward a higher Olympus, a purer deity—men come from gods, but excel the gods; then follows the inevitable decline, "the dusk of the gods," and, lastly, the assertion of man's divinity and the rehabilitation through man of the divine idea.

This thought Christianity should eternally present; but as its votaries unhappily trampled upon one-half of human life, and caricatured the other all through the middle ages, the Renaissance insisted upon reviving the types of Greek beauty and force, in order to restore the balance and reassert the place and dignity of the down-trodden senses. That protest, in the teeth of our modern religious narrowness, will continue to be popular until the reconciliation between the old and the new world-spirit is reached in a higher, freer life, recognizing and making room for the development in due balance of every part of human nature. The Greek view of life may not be adequate, but it had elements which we want; and to study art we must still go to Athens. Within his limits the Greek remains our supreme standard.

For what the Greek was, and for what he saw, his theatre found an almost perfect art-form. The dance or science of pantomimic motion was part of his daily education. His body was trained in the Palæstra, or gymnasium, and his life was one of constant drill to enable him to take part in the games and national festivals. The elastic tongue of Homer had been enriched and fired by a hundred poets before the full development of the Greek drama, and hymns and songs, set to rhythmic and choral melodies of every character and variety, supplied him with ready emotional utterance upon all occasions. Add to this the profound enthusiasm which still accompanied the ancient rites, the Delphic oracles and the Eleusinian mysteries, and we have all the materials which were woven into one harmonious whole by Æschylus—poet, warrior, stage-manager, and religious devotee.

The soul of the Greek drama, freed from accidental associations, must now be melted down in the new crucible. Wagner found there an intense earnestness of purpose—the devout portrayal of a few fundamental types—the large, clear outline like the frieze of the Parthenon—a simple plot and well-developed phases of feeling as pronounced and trenchant as the rhythmic motions of the *dramatis personæ;* and lastly he found—what he found not in Shakespeare—the Greek chorus. This gave its binding intensity to the whole drama—this provided the universal element in which the actors lived, and moved, and had their being. The chorus ever in motion—a band of youths or maidens, priests or supernatural beings, fluid and expressive, like the emotions of the vast and earnest assembly; the chorus bore aloft a wail over the agonies of Philoctetes—a plaint for Iphigenia—a questioning of the gods for Cassandra; it enveloped the stage with floods of passionate declamation; it rushed, it pointed, it swayed, it sighed, and whispered in broken, pathetic accents; it was like the sobbing of the sea on a rocky strand—the sound of the waves in Ionian caves—the wild rush of the tempest answering back man's passionate plaint, and fitting the simple feelings of the great types on the stage with an almost elemental intensity of expression. The mysterious variety of Greek metres, the varied spasmodic rhythms, can only be understood when the vision of the Greek chorus rises before us in its eager bursts of appropriate but fitful activity. That changing chant, that harsh ringing progression of notes on the Greek scales of which Gregorians are still the Christian relics, we should not call it music; it was not melody, much less harmony, but it was sound inflections marvelously used to drill declamation, posture, and pantomime. The soul of it has transmigrated in these latter days—it has become the Wagnerian orchestra.

Turn back now, for a moment, to the Shake-

spearean drama. Chorus, musical sound, band, song, all the voices of universal Nature environing man—appalling, consoling, inspiring him—have vanished. A new inner world, unknown to the Greeks, has taken their place, and man is absorbed with himself. Yet without that universal voice which he can make his own, how he shrinks, dwarfed by his narrow individuality; no longer a part of the great whole and soul of things; Nature no longer his mother, the winds no more his friends, the sea no more his comforter! The ideal atmosphere of the Greek chorus is missed; the power of music, however rudimentary, is absent. Shakespeare seems to have felt it; it passes over his sublime creations as an invocation to Music in "Twelfth Night" or in Ophelia's plaintive song. And this is the point of contact between the old drama of Æschylus and the new drama of Shakespeare: the two stand forever for the opposite poles of dramatic art—the universal type, the individual life—and both are necessary. The individual is naturally evolved from the universal, but, once evolved and developed, it must be restored to the universal, and be glorified by it.

At this crisis, in his quest after a perfect art-form, Wagner found himself confronted with Beethoven's music. He did not believe that drama could be carried further than Æschylus, Sophocles, and Shakespeare, or music any further than Beethoven; but he did conceive the project of leading the whole stream of the Beethovenian music into the channels of Shakespearean drama. The Greek chorus might have been adequate to the simple types of Greek tragedy, but modern life, with its self-conscious spirituality, its questions, its doubts, its hopes, and its immense aspirations—this seemed to require quite a new element of expression. The voice of this inner life had been preparing for four hundred years; when it was ready it turned out to be no inflexible mask, through which a human voice might speak, not even a mobile chorus, but a splendid and complex organ of expression, fitted so closely about the soul of man as to become the very Æolian harp upon which the breath of his life could freely play.

In the great world-laboratory of art Wagner found already all that he required. There was, as he remarked, nothing left for him to invent: the arts of poetry, music, painting, and pantomime, had been explored separately and perfected; nay, one step more had been made—the arts had actually been *combined* at different times in different ways. Music with pantomime and poem by the Greeks; music with pantomime, drama, painting, and every conceivable effect of stage scenery and costume, as in modern opera; music and words, as in oratorio or the cantata. But in Greece music was wholly undeveloped as an art; acting had never sounded the depths of individual life and expression. The Shakespearean drama left out music. The cantata and oratorio omitted pantomime and painting, while modern opera presented a meretricious and maimed combination of the arts resulting from a radically defective form.

With a surprising vigor of intellect Wagner has analyzed the situation, and explained exactly why he is dissatisfied with the best operatic efforts of the past, and why he seeks to supersede opera with the "musical drama."

I think his critical results may be briefly summed up thus: In the musical drama, poetry, music, scenery, and acting, are to be so blended as that each shall have its own appropriate share, and no more, as a medium of expression. The acting must not be cramped by the music, as in common opera, where a man has to stand on one toe till he has done his *roulade*, or pauses in the dead of night to shout out a song about "Hush! we shall be discovered!" when there is not a moment to spare. The music must not be spoiled for the acting, as in ballet and pantomime, where acting is overstrained to express what the sister arts of poetry and music are better fitted to convey. And poetry, which after all supplies the definite basis and answers the inevitable "why?" must not be sacrificed, as in our opera *libretti*, to the demands of singers for *aria* and *scena*, while the scenery must only attempt effects and situations which can be made to look real. The object of the grand musical drama is, in fact, to present a true picture of human feeling with the utmost fullness and intensity, freed from every conventional expression by the happy union of all the arts, giving to each only what it is able to deal with, but thus dealing with everything, leaving nothing to the imagination. The Wagnerian drama completely exhausts the situation.

Filled with this magnificent conception, Wagner looked out upon the world of modern opera—and what did he see?

First, he noticed that the opera had made a false start. It sprang, not from the earnest feeling of the miracle-plays, but from the indolent desire of the luxurious Italian nobles to listen to the delicious popular melodies in a refined form. The spontaneous street-action (which may to this day be admired in Naples or Florence) was ex-

changed for a sort of drawing-room stage, and poets were hired to reset the Italian melodies, as Moore reset the Irish melodies, for ears polite. This new aristocratic mongrel art had nothing to do with the real drama. Metastasio himself was only an Italian Mr. Chorley, the very humble servant of everybody's tunes; but these tunes had to be strung together, so the *recitative*, used for centuries in church, was borrowed; then the product was naturally a little dull, so the whole had to be whipped up with a dance; hence the *ballet*, and there you have the three fixed points of the opera—*aria*, *recitative*, and *ballet*—which to this day determine the form of modern opera. Thus opera, while it had no connection with the real drama, did not even spring from the best musical elements. "From the prosperity of opera in Italy," says Wagner, "the art-student will date the decline of music in that country. . . . No one who has any conception of the grandeur and ineffable depth of the earlier Italian church-music—Palestrina's "Stabat Mater," for instance—will ever dream of maintaining that Italian opera can be looked upon as the legitimate daughter of that wondrous mother." [1]

As ear-tickling, and not truth of expression, was the chief thing, and as there was not much to be expressed, the *arias* got wider and wider of the words, and at last the words became mere pegs, and the music totally irrelevant—as who should dance a jig over a grave.

Gluck's reform consisted in making the operatic tunes once more true to the words, but the improvement touched the sentiment only, without reaching the defective form. In France the form was slightly redeemed by the superior *libretti* and more elaborate pantomime; while in Germany opera arrived as a finished foreign production, and Mozart and others had to go to Italy to learn it. "In expressing my highest admiration of the exquisite beauties of our great masters," says Wagner, "I did not detract from their fame in showing that the cause of their weaknesses lay in the faultiness of the *genre*." [2]

And the defect of *genre* lay chiefly in the immolation of the *libretto* to the exigencies of fixed *aria*, *scena*, and *recitative*. The drama, which has to be stretched upon that Procrustean bed, must necessarily become disjointed and lifeless in the process. Rossini retarded the progress of the musical drama for at least fifty years through the absolute triumph of melody, in the most fascinating abundance, over the resources of the orchestra and the inspirations of the poet.

"His opera," writes Eduard Dannreuther, to whose pamphlet on Wagner at this season we are all so much indebted, "is like a string of beads, each bead being a glittering and intoxicating tune. Dramatic and poetic truth—all that makes a stage performance interesting—is sacrificed to tunes." Poet and musician alike had felt this. Goethe and Schiller both found the operatic form, and even the existing stage, so uncongenial that they took to writing narrative and descriptive plays not to be acted at all, and have been followed in this by Byron, Tennyson, Browning, and Swinburne. Beethoven wrote but one opera, "Fidelio," in which the breadth of the overture or overtures seems to accuse the narrowness of the dramatic form, although the *libretto* of "Fidelio" is very good as times go. Mendelssohn and Schumann could never find a suitable *libretto*.

The conclusion of all this is obvious. The perfect medium which was to combine the apparently unmanageable arts was yet to come, and Wagner proposed to himself the task of harnessing these fiery steeds to his triumphal car and driving them all together. He must choose his own subject, with a simple plot and a few strong passions and great situations. He must write his own drama, which, without being either orthodox verse or fixed metre, would aim in its mobile and alliterative pathos at following the varied inflections of natural feeling. He must arrange his own scenery, perfect in detail, and within the limits of stage possibility; and finally he must compose his own music and drill his band, chorus, and characters.

To his prophetic vision the old opera form of *aria*, *scena*, and *recitative*, has disappeared. The orchestra in a wondrous fashion floods the soul with an emotion appropriate to the situation. The drama itself advances unshackled by any musical exigency; the music flows on continuously, not imposing a form but taking its form from the emotion of the sentences as they follow each other. Snatches there are here and there of exquisite melody, broken up by part-singing, with a wild burst of chorus when needful to fulfill the dramatic occasion; but never must action be delayed, never must emotion be belied, never truth sacrificed; only at times, when the expressional power of words ceases, the music will fulfill, deepen, combine, and sometimes lift the drama almost out of itself. Then the spectator is raised into a sphere of ecstatic contemplation; the pageantry passes before his eyes as in a

[1] "Music of the Future." Letter to F. Villot. p 10.
[2] Ibid., p. 22.

dream, while his soul lives and moves only in the ideal sphere of the varied and intense passions which are being played out before him.

III.

While these perceptions and aims were slowly maturing in him, Wagner found himself constantly at war with his age and his surroundings.

At sixteen, he had resolved to devote himself to music, finding in it the ineffable expression for emotions otherwise mainly inexpressible. Musical notes and intervals were to him radiant forms and flaming ministers. Mozart taught him that exquisite certainty of touch which selects exactly the right notes to express a given musical idea. Weber taught him the secret of pure melody, how to stamp with an indelible type a given character, as in the return of the Samiel motive in "Der Freischütz;" he also perceived in that opera the superiority of legend and popular myth, as on the Greek stage, to present the universal and eternal aspects of human life in their most pronounced and ideal forms. Beethoven supplied him with the mighty orchestra, capable of holding in suspension an immense crowd of emotions, and of manipulating the interior and complex feelings with the instantaneous and infallible power of a magician's wand. Schubert taught him the freedom of song—Chopin the magic elasticity of chords, Spohr the subtile properties of the chromatic scale—and even Meyerbeer revealed to him the possibilities of stage-effect through the grand opera. Shakespeare, Goethe, and Schiller, suggested the kind of language in which such dramas as "Lohengrin" and "Rheingold" might be written; while Madame Schröder-Devrient revealed to him what a woman might accomplish in the stage presentation of ideal passion with such a part as Elsa in "Lohengrin" or Brunhild in "Walküre."

But the immediate result of this, as I have said, was not promising. Contrary to the advice of his friends, he had thrown himself, heart and soul, into the study of music as a profession. Under the Cantor Weinlig, at Leipsic, and while at the university, he produced an overture and symphony, which were played and not unfavorably received at the Gewandhaus; but his early work, with here and there an exceptional trait in harmony, was nothing but a pale copy of Mozart, as may be seen from a poor little piano sonata lately republished by Breitkopf.

His health now broke down. He was twenty years old (1833), and he went to his brother, a professor of music at Würzburg, where he staid a year, at the end of which time he was appointed musical director at the Magdeburg Theatre, where, under the combined influence of Weber and Beethoven, he produced two operas—"The Fairies" and "The Novice of Palermo"—neither of which succeeded. He left his place in disgust, and obtained another post at the Königsberg Theatre. There he married an actress, a good creature, who, without being much to blame, does not seem to have materially increased his happiness, but who decidedly shared the opinion of his friends that the composition of "pot-boilers" was superior to the pursuit of the ideal. The ideal, however, haunted Wagner, and—poverty.

In 1836 he left with Mina for Riga, on the shores of the Baltic, and there, as *chef d'orchestre* at the theatre, he really appears to have enjoyed studying the operas of Mehul, Spontini, Auber, and Berlioz; for, while suffering what he describes as a dull, gnawing pain at the frequent irrelevance of the sentiment to the music, the nobler correspondences and beautiful inspirations gave him far-off glimpses of that musical drama to which he even now dimly aspired.

In the midst of his routine duties Bulwer's novel, "Rienzi," struck his imagination. There, as on a large and classic stage, was portrayed that eternal revolt of the human spirit against tyranny, routine, selfishness, and corruption, of which the Polish insurrection of 1831 and the Revolution of July were the modern echoes. Rienzi, a tribune of the people, dreaming of the old austere republic, in the midst of corrupt papal Rome—a noble heart, a powerful will at war with a brutal and vulgar age, supported, cheered by the enthusiasm of a devoted and patriotic sister—raised by a wave of popularity to the highest summit of human power, then hurled down by the papal anathema, betrayed by a mean and cowering aristocracy, banished by the mob that had so lately hailed him as a deliverer, and at last falling by a treacherous hand upon the charred and crumbling ashes of his own homestead, the last great tribune of Rome!—here was a subject with immense outlines, full of situations in which the greatest breadth might be joined to the most detailed inflections of feeling. In it Wagner, while not departing avowedly from the form of the grand opera then in vogue at Paris, has in fact burst the boundaries. "Rienzi" is already the work of an independent master; it is at least prophetic of "Lohengrin" and "Tristan," while comparing favorably in pure melody and sensational effects with any of the current

operas. What rush, triumph, aspiration, about the large outlines and tramping measures of the overture—what *élan* and rugged dignity in the choruses — what elevation in Rienzi's prayer, "God of Light!"—what fervor and inexhaustible faith in the phrase, "Thou hast placed me as a pilot on a treacherous and rocky strand;" what imagery, as of vast buildings and ranged towers dimly seen athwart the dull-red dawn, in the music of "Scatter the night that reigns above this city," and what chastened exaltation, free from all Italian flourish or ornament, of "Rise, thou blessed sun, and bring with thee resplendent liberty!"

But in 1839, which saw the text and the completion of the first two acts, we are far indeed from the production of "Rienzi;" it struck, however, the key-note of a most important and little understood phase in Wagner's career—the political phase.

IV.

Musicians, poets, and artists, are not, as a rule, politicians. Their world is the inner world —the world of emotion and thought, which belongs to no special age or clime, but is eternal and universal. Goethe and Beethoven cared little for revolutions, and have even been deemed wanting in patriotism. But Wagner was a hot politician. He was at one time a mob orator, and was seduced by his illustrious friend Rockel, who was afterward put in prison, to throw himself at Dresden into the rise of Saxony and the agitations of 1848. He was proscribed and banished from German soil, and years afterward, when he had, if not recanted, at all events acquiesced in things as they were, he was obliged to fly from Munich, warned by the friendly king that his life was in danger. The title of but one of his numerous semi-political pamphlets, "Art and the Revolution," gives us the real clew to all this. People have accused Wagner of time-serving and change in politics, but the fact was, that he favored social revolution *because* he thought it needful to art revolution. Conventionality and stagnation in art seemed to him the natural outcome of conventionality and stagnation in society; the world must be recalled to feeling and reality before art could again become the ideal life of the people, as it was once in Greece. But when, through royal patronage later on, all impediments to the free development of his art-work disappeared, his revolutionary tendencies also disappeared. He too was, first and foremost, Artist, and he came to realize his vocation, which had to do with art, and with "the Revolution" only in so far as it affected "Art."

But, in fact, no ardent soul could escape the romantic and revolutionary contagion that swept over France, Germany, and even England, between 1830 and 1850. Europe seemed to breathe freely once more after the iron hand of Napoleon I. had been lifted from her oppressed bosom —but then, like a wayward child, she burst into all kinds of excesses.

The atheism of the first Revolution, the brutality of Napoleon Bonaparte's administration, the dullness of Louis Philippe's, the revived taste for Greek art combined with the inflexible dogmatism of the papal creed—all these conspired to fill the ardent youth of the period with a deep revolt against things as they were. With this came a settled longing for a return of some sort to Nature and freedom, and a vague but intense aspiration toward the ideal and immaterial world, which in other times might have taken the form of a religious revolution, but in 1830 broke out in what has been called "Romanticism" in Art. It was seen in the writings of Mazzini and the mutterings of Italian freedom, in the insatiable and varied developments of Madame Sand's genius, in the wild and pathetic cries of Alfred de Musset, in the sentimentalism of Lamartine, in the vast scorn and bitter invective of Hugo, in the heart-broken submission of Lacordaire, and in the despair of De Lamennais. Byron, Shelley, and Tennyson, caught both the most earthly and the most heavenly echoes of the romantic movement in England; while its inner life and genius have found, after all, their most subtile expression in the music of Beethoven, Mendelssohn, Schumann, Berlioz, Chopin, Wagner, Liszt, and Rubinstein.

"It seems, indeed," writes Wagner, in one of those veins of flashing perception in which he so abounds, "that human sentiment, as if intensified by the pressure of conventional civilization, had sought an outlet for asserting itself according to its own laws of expression. The astounding popularity of music in our time proves the correctness of the supposition that the modern development of this art has met an innate desire of the human spirit." [1]

V.

Wagner had left Magdeburg for Riga, but he soon came to the end of his tether there. A stupid little provincial town was not likely to become then what Wagner has made Baireuth

[1] Letter to Villot, p. 30.

since—the stage for turning upside down the art-theories of the civilized world. Pushed by what he calls "despair," without money and without friends, but with that settled faith in himself which has made him independent of both until it has won both, the obscure *chef d'orchestre* resolved to go to Paris and storm the Grand Opéra, then at the feet of Rossini and that strange, unscrupulous *bric-à-brac* composer, Meyerbeer! The small vessel in which he sailed was blown about the Baltic for three weeks, put into many desolate coast-nooks, and nearly wrecked. After many hardships, shared with the rough and often starving crew, the lonely musician arrived in London (1840), with his head full of Paris and the Grand Opéra, and with "Rienzi" in his carpet-bag.

While here he playfully seized the musical *motif* of the English people. It lay, he said, in the five consecutive ascending notes (after the first three) of "Rule Britannia:" there was expressed the whole breadth and downright bluff "go" of the British nation. He threw "Rule Britannia" into an overture, and sent it by post to Sir George Smart, then omnipotent musical professor in London; but the postage being insufficient, the manuscript was not taken in, and at this moment is probably lying in some dim archive of the post-office, "left till called for."

Crossing to Dieppe, he met the crafty and clever Meyerbeer, who instantly saw the man he had to deal with, and probably conceived in a moment that policy of apparent support and slow intrigue which made him throughout life Wagner's meanest and bitterest foe.

It has been most unwarrantably asserted that Wagner hated the Jews because of Meyerbeer and Mendelssohn, and hated Meyerbeer and Mendelssohn because they were successful; but Wagner's dearest friends have been Jews: he only objected to the low level of their art-theories; and if he hated Meyerbeer and Mendelssohn, it was not simply because they had the ear of Europe, but because they and their friends kept every one else out of the field, while Meyerbeer debased musical art to the level of the vulgarest sensation, and Mendelssohn never rose, in Wagner's opinion, above the plane of a shallow sentimentalist, while creating a drawing-room standard of excellence to which every one soon learned to bow down.

In this opinion I shall never concur. Mendelssohn has been to me as much a revelator of the beautiful as Wagner has been of the sublime. Nothing is more painful to me than the bitter opposition between the friends of Mendelssohn and Wagner. These two great spirits were probably as antipathetic as Moore and Wordsworth, but although Wagner is *the* inexorable and colossal development in art since Beethoven, Mendelssohn reigns forever in a sweet wayside temple of his own, full of bright dreams and visions, incense and ringing songs. And partly is he so sweet because, unburdened with any sense of a message to utter, a mission to develop, he sings like a child in the valleys of asphodel, weaving bright chaplets of spring-flowers for the whole world, looking upon the mystery of grief and pain with wide eyes of sympathy, and at last succumbing to it himself, but not understanding it, with a song of tender surprise upon his lips.

Wagner passed two terrible years, 1840–'42, in Paris. Meyerbeer had given him introductions, and introduced him later to M. Joly, a stage-director at Paris, whom he knew to be on the point of bankruptcy, and who suspended the rehearsal of "The Novice of Palermo" at the last moment. But this was but the end of a series of checks. He wrote an overture to "Faust." His good friend and faithful ally, Schlesinger, editor of the *Gazette Musicale*, got it rehearsed at the Conservatoire. It sounded quite too strange and queer to those ears polite, and was instantly snuffed out.

He submitted a *libretto* "Love Forbidden," to a theatrical manager, but it had not a chance, and dropped. Schlesinger now employed him to write, and he wrote articles and novels, and so kept body and soul together. No one would listen to his music, but he was not a bad hack, and was hired for a few francs to arrange Halévy's "Queen of Cyprus" for the piano, and the latest tunes of Donizetti and Bellini for piano and *cornet-à-piston*.

At night he stole into the Grand Opéra, and there, as he tells us, felt quite certain that his own works would one day supersede the popular efforts of Rossini and Meyerbeer. He does not seem to have been dejected like a lesser soul; in what the French called his *immense orgueil*, he was sorry for their want of appreciation, but never dreamed of altering *his* ideas to suit them. "Je me flattais," says the unpaid musical hack, "d'imposer les miennes." Meanwhile the splendid band of the Conservatoire, under Habeneck, consoled him, and on the boulevards he often met and chatted with Auber, for whom he had a sincere respect and admiration. Auber was at least a conscientious musician of genius, who knew his business, and did not debase what was

at no time a very exalted, but still a legitimate, branch of his art, the *opéra comique;* and, besides, Auber was a *bon camarade*, and liked Wagner, probably without understanding him.

After months of drudgery, and chiefly penny-a-lining for the *Gazette Musicale*, Wagner felt the imperious necessity for a return to his own art. He took a little cottage outside Paris, hired a piano, and shut himself up. He had done, for a time, at least, with the mean, frivolous, coarse world of Paris—he did not miss his friends, he did not mind his poverty. He was again on the wild Norwegian coast, beaten about with storms, and listening to the weird tales of mariners, as in broken and abrupt utterances, or with bated breath, they confided to him the legend common in one form or other to seafaring folk in all parts of the world—the legend of the Flying Dutchman. The tale sprang from the lives and adventures of those daring navigators of the fifteenth and sixteenth centuries, and reflects the desperate struggle with the elements, the insatiable thirst for the discovery of new lands athwart unknown seas, and it seems to embody forever the avenging vision of men who, resolved to win, had so often dared and lost all.

A famous captain, mad to double the Cape of Storms, beaten back again and again, at length swears a mighty oath to persevere throughout eternity. The devil takes him at his word. The captain doubles the cape, but is doomed to rove the seas forever from pole to pole—as the Wandering Jew to tread the earth—his phantom-vessel the terror of all mariners, and the dreadful herald of shipwreck. Here was a legend which needed but one inspired touch of love to make it a grand epitome of seafaring life, with its hard toils, its forlorn hopes, and its tender and ineffably sweet respites. The accursed doom of the Flying Dutchman can be lifted by human love alone. The captain, driven by an irrepressible longing for rest, must land once in seven years, and if he can find a woman who will promise to be his and remain faithful to him for one term of seven years, his trial will be over—he will be saved.

The legend thus humanized becomes the vehicle for the expression of those intense yet simple feelings and situations which popular myth, according to Wagner, has the property of condensing into universal types. Immense unhappiness, drawn by magnetic attraction to immense love, tried by heart-rending doubt and uncertainty, and crowned with fidelity and triumphant love, the whole embodied in a clear, simple story, summed up in a few situations of terrible strength and inexorable truth—such is Wagner's conception of the drama of "The Flying Dutchman," with its "damnation" motive belonging to the captain and its "salvation" motive given to the bride; its sailor's subject; its pilot's song; its spinning-wheel home-melody; and its stormy "Ho! e ho!" chorus; and the whole, shadowed forth in the magic and tempestuous overture, stands out as this composer's first straightforward desertion of history proper, and adoption of myth as the special medium of the new musical drama.

Six weeks of ceaseless labor, which to Wagner were weeks of spontaneous and joyful production, sufficed to complete the music of "The Flying Dutchman." The immediate result in Paris was ludicrous. The music was instantly judged to be absurd, and Wagner was forced to sell the *libretto*, which was handed over to a Frenchman, M. P. Fouché, who *could* write music. It appeared with that gentleman's approved setting, under the title of "Le Vaisseau Fantôme."

This was enough! No lower depth could well be reached, and Wagner was preparing to leave Paris to the tender mercies of Rossini, Meyerbeer, and M. P. Fouché, when news reached him from Germany that "Rienzi," flouted in the capital of taste, had been accepted in Berlin and Dresden!

VI.

It was the spring of 1842, and it was also the rapid and wondrous turn of the tide for Wagner. He hurried to Dresden, to find the rehearsals of "Rienzi" already advanced. The opera was produced with that singular burst of enthusiasm which greets the first appreciation of an important and long-neglected truth, and Wagner, having become the favorite of the crown-prince, was elected Kapellmeister at Dresden, and found himself for the first time famous. Some might now have rested on their laurels, but, to Wagner's imperious development, "Rienzi" was already a thing of the past. He had drunk of the crystalline waters of popular myth, and was still thirsty. "The Flying Dutchman" had opened up a new world to him, more real because more exhaustive of human feelings and character than the imperfect types and broken episodes of real history. He seemed to stand where the fresh springs of inspiration welled up from a virgin soil; he listened to the childlike voices of primitive peoples, inspired from the simple heart of

Nature, and babbling eternal verities without knowing it. Legend was the rough ore—the plastic element he could seize and remould, as Æschylus remoulded Prometheus, or Sophocles Œdipus, adding philosophic analysis and the rich adornments of poetic fancy and artistic form.

The legend of Tannhäuser now engrossed him. The drama was soon conceived and written. There he summed up, in a few glowing scenes, the opposition between that burst of free, sensuous life at the Renaissance, and the hard, narrow ideal of papal Christianity. Christ not only crowned with thorns, but turned into stone, is all the answer that Christianity had to give to that stormy impulse which at last poured its long-pent-up torrent over Europe. The deep revolt still stares us in the face from the Italian canvases as we look at the sensuous figures of Raphael or Titian —the free types of fair, breathing life, surrounded with the hard aureole of the artificial saint, or limned as in mockery, like the dreams of a pagan world upon the walls of the Vatican.

Tannhäuser a Thuringian knight, taking refuge with Venus, no longer the beneficent Holda, joy of gods and men, but turned by the excesses of the ascetic spirit into a malign witch, and banished to the bowels of the earth in the Venusberg—Tannhäuser, with a touch eternally true to Nature, bursting the fetters of an unruly, sensual life, and sighing for a healthier activity; Tannhäuser, seeing for a moment only, in the pure love of Elizabeth, the reconciliation of the senses with the spirit, a reconciliation made forever impossible by the stupid bigotry of a false form of religion, but which is ultimately sealed and accomplished by love and death in heaven—this is the human and sublime parable of the drama, wrought out with the fervor of a religious devotee, and epitomized in that prodigious overture wherein the dirge of the Church mingles with the free and impassioned song of the minstrel knight, and clashes wildly with the voluptuous echoes of the fatal Venusberg.

Wagner's progress was now checked by that storm of invective which burst out all over Germany—not on account of "Rienzi," but in consequence of "The Flying Dutchman," and especially of "Tannhäuser." The reason is simple. The power of "Rienzi," the audacity of its sentiment, the simplicity of its outline, and the realism of its *mise en scène*, together with a general respect for the old opera forms, insured it a hearing which resulted in a real triumph. But in "Tannhäuser" the new path was already struck out, which singers, band, audience, critics, and composers, in a body, refused to tread; in short, *aria*, *recitative*, and *ballet*, were dethroned, and suddenly found themselves servants where they had been masters.

In 1843 "The Flying Dutchman" was produced at Dresden, and failed. "Rienzi" was still revived with success. Wagner now sent the "Dutchman" and "Tannhäuser" to various theatres. The former was tried at Berlin in 1844, and failed. Spohr had the intelligence to take it up at Cassel, and wrote a friendly and appreciative letter to Wagner, but the MS. scores were, as a rule, returned by the other theatres, and the new operas seemed to react on the earlier success, for at Hamburg "Rienzi" failed.

Meanwhile, failure, together with the close sympathy of a few devoted friends, convincing him that he was more right than ever, Wagner now threw himself into the completion of that work which is, perhaps, on the whole, his most perfect, as it certainly is his most popular creation, "Lohengrin." The superb acting and singing of Mesdemoiselles Titiens, Nilsson, and Albani, will be fresh in the minds of many readers. The choruses in England have never yet been up to the mark, but the band under Sir Michael Costa, at its best, renders the wondrous prelude to perfection.

The whole of "Lohengrin" is in that prelude. The descent of the Knight of the Swan from the jasper shrines of the sacred palace of Montsalvat, hidden away in a distant forest-land; his holy mission to rescue Elsa from her false accusers; his high and chivalric love; his dignified trouble at being urged by her to reveal his name, that insatiable feminine curiosity which wrecks the whole; the darker scenes of treachery by which Elsa is goaded to press her fatal inquiry; the magnificent climax of the first act; the sense of weird mystery that hangs about the appearance and reappearance of the swan, and the final departure of the glittering Knight of the Sangraal; allegory of heavenly devotion stooping to lift up human love, and dashed with earth's bitterness in the attempt: to those who understand the pathos, delicacy, and full intensity of the "Lohengrin" prelude, this and more will become as vivid as life and emotion can make it. "Lohengrin," in its elevation, alike in its pain, its sacrifice, and its peace, is the necessary reaction from that wreck of sensual passion and religious despair so vividly grasped in the scenes of the Venusberg, in the pilgrim chant, and the wayside crucifix of "Tannhäuser."

VII.

"LOHENGRIN" was finished in 1847, but the political events of the next few years brought Wagner's career in Germany to an abrupt conclusion. His growing dissatisfaction with society coincided, unconsciously, no doubt, with the failure of his operas after that first dawn of success. He now devoted himself to criticism and politics. He read Schopenhauer, whose pessimist philosophy did not tend to soothe his perturbed spirit; and during the next ten years, from 1847 to 1857, he spoke to the world from different places of exile in that series of political and æsthetical pamphlets to which I have before alluded.

In 1855, owing to the earnest advocacy of M. Ferdinand Praeger, who, for thirty years, through evil report and good report, has never ceased to support Wagner, the Philharmonic Society invited him over to London, and while here he conducted eight concerts. He was not popular; he was surprised to find that the band thought it unnecessary to rehearse, and the band was surprised that he should require so much rehearsal. But he drove the band in spite of itself, and the band hated him. They said he murdered Beethoven with his *bâton*, because of the freedom and inspiration of his readings. Mendelssohn's Scotch symphony had been deliberately crushed, or it was the only thing that went, according to which paper you happened to read. He did not care for the press, and he was not much surprised that the press did not care for him. The unfailing musical intelligence of the queen and Prince Albert was the one ray of sunlight in this his second visit to our inhospitable land, but the power of the man could not be hid even from his enemies; his culture astonished the half-educated musicians by whom he was surrounded, his brilliant originality impressed even his own friends, who saw him struggling through an imperfect acquaintance with French and English to make himself understood.

One evening, alone in company with M. Sainton, Hector Berlioz, and Ferdinand Praeger, Wagner surprised them all by suddenly launching out on art, music, and philosophy. Berlioz was an elegant speaker, accustomed to lead easily; but Wagner, with his torrent of broken French and his rush of molten ideas, silenced, bewildered, delighted, and astonished them all. Berlioz is gone, but that night still lives in the memory of those who were present and who survive.

Thus, Wagner passed through England for a second time, leaving behind him a vague impression of power and eccentricity, the first of which the musical press did its best to kill, while fanning the second into a devouring flame, which swallowed up Wagner's reputation. Notwithstanding Praeger's exertions, twenty-one years flitted by, and little enough was heard of Richard Wagner in this country until, owing to the increasing agitation of a younger school of musicians, foremost among whom we must name Mr. Eduard Dannreuther and Mr. Walter Bache, "The Flying Dutchman" was at last indifferently produced at Covent Garden.

In 1874 Herr Hans von Bülow, pupil of Liszt, and great exponent of Wagner's music, came over, and, by his wonderful playing, aided steadily by the periodical Wagnerian and Liszt concerts given by Messrs. Dannreuther and Bache, brought about the rise of the new Wagner movement in England, which received its development in the interest occasioned by the Baireuth Festival, and reached its climax in the Wagner Festival actively promoted by Herr Wilhelmj, and undertaken by Messrs. Hodges and Essex, in 1877, at the Albert Hall.

I have anticipated a little, because space obliges me to draw briefly to the close of this sketch. Mina, Wagner's first wife, was now dead. I cannot here tell at length how Liszt (whose daughter, Cosima von Bülow, became Wagner's second wife in 1870) labored with untiring zeal to revive Wagner's works, and how his efforts were at last crowned with success all over Germany in 1849–'50. It was a popular triumph. I remember old Cipriani Potter, the friend of Beethoven, saying to me at the time when the English papers teemed with the usual twaddle about Wagner's music being intelligible only to the few, "It is all very well to talk this stuff here, but in Germany it is the people, the common people, who crowd to the theatre when 'Tannhäuser' and 'Lohengrin' are given." I have noticed the same at the Covent Garden concerts; it was always the pit and gallery who called for the Wagner nights, while the opera which had the great run with Carl Rosa's English company was "The Flying Dutchman," and "Tannhäuser" and "Lohengrin" at both the other houses were invariably the crowded nights.

In 1861 the Parisians showed their taste and *chic* by whistling "Tannhäuser" off the stage.

In 1863 Wagner appeared at Vienna, Prague, Leipsic, St. Petersburg, Moscow, Pesth, and conducted concerts with brilliant success. In 1864 his constant friend the crown-prince, now Lud-

wig II. of Bavaria, summoned him to Munich, where the new operas of "Tristan" in 1865, and "Meistersinger" in 1868, "Das Rheingold" in 1869, and "Die Walküre" in 1870, were successively given with ever-increasing appreciation and applause.

The "Meistersinger," through which there runs a strongly comic vein, deals with the contrast between the old stiff forms of minstrelsy by rule and the spontaneous revolt of a free, musical, and poetical genius, and the work *forms* a humorous and almost Shakespearean *pendant* to the great and solemn minstrelsy which fills the centre of Tannhäuser. In Wagner's opinion it is the opera most likely to find favor with an English audience, a point which we hope an English audience may soon determine for itself.

"Tristan and Iseult," in which the drama and analysis of passion—love and death—is wrought up to its highest pitch, was thrown off between the first two and last two great sections of the Tetralogie; and the Tetralogie, itself planned twenty years ago, and produced at Baireuth in 1876, stands at present as the last most daring and complete manifestation of Wagner's dramatic, poetic, and musical genius.

The purpose and power of that great cycle of Scandinavian and German myths, unrolled in the four colossal dramas of "Rheingold," "Walküre," "Siegfried," and "Gotterdämmerung," would carry me far beyond the limits of this article. Fragments only of the music can be presented in the concert-room, and these, bereft of the sister arts, must necessarily lose much of their effect. But after studying well the written drama, we may close our eyes and allow some of the Baireuth scenes to flash once more before the mind's eye.

The elemental prelude of the "Rheingold," full of deep and slumberous sounds, wafts us away from all account of time and space. The dim gray-green depths of the Rhine alone become visible. We are aware of the deep moving of the Rhine-water, and the three Undines are seen like faint shadows, swimming and singing, guardians of the Rheingold. The dark King of the Undergrounds comes climbing after them among the rocks, but he is scarcely visible in the gloom. Presently the Rheingold begins to brighten. A shaft of radiance strikes through the water—the Undines scream with joy; then through the whole depths of the Rhine streams an electric light, shining upon a distant rock, dimmed to softest yellow only by the water, and the famous "Rheingold! Rheingold!" wild cry of the Rhine-daughters breaks forth with the golden illumination of the Rhine-depths.

Or let the curtain rise on the last farewell duet between Brünnhild and the god Wotan. To long-drawn-out enchanting melody Brünnhild's head sinks on her father's breast—she can but sob that she has loved him dutifully, and implore him if she is to become a mortal's bride to surround her rock with fire, and bar her from all but the bravest. It is now almost dark, a faint-red light lingers on the supple yet lordly form of Brünnhild. A strange languor comes over her—the god lays her gently on the rock—and waves her into her long sleep. Then he calls for the fire-god—and as he lifts his spear a burst of fire breaks out and runs round the stage—in another moment the whole background is an immense wall of rose-colored flame. To the most enchanting and dreamlike music of silver bells, harps, and flutes, the sleep of the Walküre begins—the god scales the rocks, stands for a moment in the midst of the fire, then passes through it out of sight as the curtain falls.

But, indeed, it is hard to select. The exquisite scene where Siegfried listens to the birds in the golden summer woods, and understands their language; the wild mountain-rocks, and the war-maidens rushing through the clouds, alighting and shouting to each other from peak to peak; or the passage of the gods over the rainbow-bridge into the halls of Walhalla; or, lastly, the death of Siegfried and the dusk of the gods—the Albert Hall festival will revive gleams of all these.

Long will that prodigious last scene of the "Götterdämmerung" linger in the memory of those who saw it at Baireuth. Brünnhild draws the gold ring of the Rheingold—the cause of such grief and manifold pain—from her finger, and flings it back into the Rhine whence it was stolen. Her black Walküre horse has been brought to her; she waves high a flaming torch, and casts it upon the bier of Siegfried. The flames rise in vast fiery columns. At that moment, in the lurid glow of the flaming pyre, the water, still flashing with moonlight behind, begins to surge up and advance upon the shore; and the Rhine-daughters, singing the wildest Rhine-music, are seen floating to and fro. Beyond, a ruddy light broadens until the distant sky discloses the courts of the Walhalla in flames. With a crash like thunder, in the foreground the house of Hagen falls, and, while the mighty conflagration flares up in the distance, the Rhine overflows to rushing music and submerges the whole stage. With this scene of un-

equaled dramatic splendor ends the immense dramatic cycle of the "Nibelungen-Ring," and, quite apart from the music, we may well be impressed with the poetical genius which has welded all these strange elements of Scandinavian and Germanic myth into such a whole.

But Wagner himself is in our midst. He has at last become to the English people his own best interpreter; and, now that after a struggle of forty years kings are his patrons, and the *élite* of Europe have gathered to the Olympian-like festival at Baireuth—now that the clamors and sneers of malcontents and irreconcilables are drowned by the applause and recognition of a fairly representative English public, we can recall, with a smile of pity and forgiveness, the past bickerings of the press, or that *naïve* dictum of worthy M. Fêtis, in 1866: "To-day, the transient curiosity about Wagner is satisfied—indifference has come, and the so-called music of the future is already a thing of the past!"—*Contemporary Review.*

CENTRAL AFRICA AND THE BRUSSELS GEOGRAPHICAL CONGRESS.[1]

By ÉMILE DE LAVELEYE.

IN September of last year the King of the Belgians received with gracious and royal hospitality, in his palace at Brussels, the presidents of the principal geographical societies of Europe, and a number of other personages who, by their travels, their researches, or their philanthropy, have become representatives of the idea of the civilization of Africa. In his letter of invitation, King Leopold had clearly defined the work to be done by this congress. Several important and heroic expeditions, maintained by private subscription, have penetrated to the interior of Africa.

"These expeditions," said the king, "were animated by the eminently progressive and Christian idea of abolishing slavery in Africa; of penetrating the darkness which still envelops that portion of the world; of studying its apparently boundless resources—in a word, of carrying thither the blessings of civilization: such are the aims of this modern crusade—a crusade worthy of the age in which we live. The efforts that have hitherto been made have had no concert of action, and hence arises on all sides the desire that they who labor for a common end should confer together, with a view to coördinate their movements, to establish a few landmarks, and to portion out the regions to be explored, so that work already done shall not be repeated."

King Leopold II., as being the sovereign of a small country, is naturally disposed to concern himself with the general interests of the globe. Being still too young to be, like his father, the counselor of the sovereigns of Europe and their go-between in their secret negotiations, Leopold II. has taken a lively interest in the future of the extreme East. Prior to his ascending the throne, as a skilled and wide-awake observer he visited Egypt, India, and China, bringing back, as the fruit of his travels, the conviction that, if European industry is to continue in its wonderful career of progress, new outlets must be provided for it in these great continents, which hold three-fourths of the world's population. North America, the victim of a blind and narrow commercial policy, will not take our products; we must, therefore, push on farther, and open new markets in Asia and Africa. Toward Africa especially must we direct our efforts, for there, besides the development of commerce, a work of humanity remains to be done—namely, the suppression of the slave-trade, and, as a consequence of this, the prevention of the abominable wars which now depopulate those rich and fertile countries. In furtherance of the work of exploring Central Africa, King Leopold wished to submit for discussion to the Geographical Congress assembled in his palace three chief points, viz.:

"1. The establishment of bases of operation on the Zanguebar coast and near the mouth of the Congo; 2. The determination of routes to be successively opened to the interior, with stations for scientific observation, pacification of the natives, and entertainment of travelers; 3. The appointment of an international and central committee for the purpose of putting this project into execution,

[1] Translated by J. Fitzgerald, A. M.

calling to it the attention of the public in all countries, soliciting aid, and raising subscriptions."

The noble idea of the King of the Belgians was duly appreciated by those to whom it had been submitted, and a number of travelers, geographers, and philanthropists, from the various countries of Europe, came together in answer to the call. France was represented by Admiral La Roncière Le Noury, President of the Paris Geographical Society; M. Manoir, secretary of the same society; Henri Duveyrier, the explorer of the Sahara; the Marquis de Compiègne, then just back after his perilous travels in the unexplored regions of the Ogowai. M. de Lesseps visited Brussels later, and fully approved the project. Germany sent her three most distinguished travelers, G. Rohlfs, Schweinfurth, and Nachtigal, of whom the last-named had a little before received the grand medal of the Paris Geographical Society. Besides these, there were present, from Italy, the Commendatore Negri: from Prussia, the Baron von Richthofen, President of the Geographical Society of Berlin: from the Austro-Hungarian monarchy, Herr von Hochstetter, President of the Geographical Society of Vienna; Count Edmond Zichy; Baron Hoffmann, Minister of Finance; and Lieutenant A. Lux, who had just returned from his brilliant excursion to an unexplored portion of the basin of the Coango: from England, Sir Rutherford Alcock, President of the Geographical Society of London; Sir Bartle Frere, Vice-President of the Council of the East Indies, and now Governor of Cape Colony; Sir Henry Rawlinson, well known on account of his discoveries at Nineveh; Colonel Grant, who, with his friend Speke, made known the existence of the great lakes of Central Africa; Commander Cameron, whose march from the east to the west coast of Africa, by way of Lake Tanganyika and the Lualaba, is now famous; together with such eminent philanthropists as Sir Harry Verney, Sir John Kennaway, Sir T. Fowell Buxton, Mr. W. Mackinnon, and Admiral Sir Leopold Heath. Belgium, not having any distinguished travelers, was represented only by men whose coöperation might contribute to the success of the work at home; and one of the Belgian members, Émile Banning, has just published a work of merit, in which he sets forth the present state of our knowledge with regard to Central Africa, and also gives a synopsis of the work done by the congress.[1] After four days of discussion, the conclusion was reached that it would be advisable to establish a line of permanent stations reaching from Bagomoyo on the coast of Zanguebar to St. Paul de Loanda on the Atlantic coast, in the Portuguese possessions, the first stations being fixed at Ujiji, on the eastern shore of Lake Tanganyika, at Nyangwe on the Lualaba, Livingstone's farthest point northward, and at a point to be yet fixed in the dominions of Muata Yamvo, one of the most powerful chiefs of Central Africa. This is the route so gloriously followed by Commander Cameron.

But what is to be the character and the purpose of these stations? English and German travelers are unanimously agreed that they must not be military in any sense. As was well said by Sir Bartle Frere, they must act by gentleness, by persuasion, by the natural ascendency of civilized man over barbarous races. Armed force provokes hostility on the part of the chiefs, and then, if we must defend ourselves, we have war, conquest. The colony should be small in numbers, but active, disinterested, and able-bodied. At its head should be a man accustomed to command—a naval officer, for instance; there should be a physician-naturalist, and a few skilled artisans, especially a carpenter and a machinist. According to a communication which I have received from Sir Fowell Buxton, the Free Church of Scotland has collected 260,000 francs and founded a station, known as Livingstonia, on the shore of Lake Nyassa, from which flows one of the affluents of the Zambesi; the *personnel* of this station comprises a naval lieutenant as commandant, a carpenter, a machinist, a weaver, and three agricultural laborers, besides two missionaries. The station of Mombasa, on the coast of Zanguebar, is after the same model, as is also the Anglican Church Expedition to Uganda, whose object is to establish a post between Lakes Victoria and Albert.

Of course, the stations founded by the International Congress could not take part in a religious propaganda, inasmuch as they would have to be supported by contributions from persons belonging to every sect. While sympathizing fully with the efforts made to spread the gospel, they would themselves be exclusively laic. Their main object is to serve as bases of operations for travelers *en route* to the interior with a view to penetrate regions as yet unexplored. At present the explorer, on quitting the coast, must take with him provisions, instruments, and, above all, goods for barter sufficient to supply his wants for months, or even for years. Hence he must keep an endless string of porters, who quickly use up his

[1] "L'Afrique et la Conférence Géographique de Bruxelles," 1877.

resources, and who, by their frequent desertions, continually delay his progress. It would be of incalculable advantage, therefore, if the traveler could find in the interior of the country the supplies he requires, and if the starting-point, instead of being at a point on the coast, as Bagomoyo or St. Paul de Loanda, were situated on the very threshold of the unexplored regions which he designs to visit, for instance at Nyangwe or at Ujiji. These stations would constitute a sort of entrepots where he might supply himself with everything needed, and a place of refuge whither he might retire in case of illness or reverse. The privations, the sufferings of every kind that befell the Livingstones, the Nachtigals, the Grants, the Camerons, and which prevented them from following up their discoveries, would henceforth be in a great measure avoided by those who should walk in their footsteps. The heads of these posts, being men of scientific training, would soon become acquainted with the resources of the country. They could serve as guides to explorers; they could make known to Europe the proper commodities to export, and could thus open new routes to commerce. The handiwork of the European artisans being performed under the eyes of the natives, the latter would be thus initiated into the arts and the needs of civilized life, and in this way a civilizing influence would be gradually spread abroad. The Catholic mission at Gondokoro held its own in the very heart of Equatorial Africa, and changed its site only in order to escape from the dreadful mortality caused by fevers. Here is proof that stations of this kind, though they possess no military character, may be established, and may even prosper, in these regions.

Stations having been founded in the interior, the facility of supplying them with provisions will depend on their means of communication with the coast. Hitherto everything has been carried on the heads of the negroes—a system of transport which occasions delays and difficulties that can only be appreciated by those who have read the narratives of Livingstone, Stanley, and Cameron. An agent of the London Missionary Society is now engaged in surveying a route for ox-teams from the coast of Zanguebar to Lake Tanganyika, and during the present spring an expedition consisting of five or six members will attempt to make the journey. To me it appears that a much surer method of transportation would be by means of elephants. The English brought several elephants from India for use in their Abyssinian war, and there these powerful animals rendered great services, despite the many deep ravines that had to be crossed. In Equatorial Africa the elephant would be, as it were, in his native country, for the African species is abundant there. He would find appropriate food, and would have nothing to fear from the redoubtable tsetse-fly. In this way goods could be carried much more easily than on the backs of men, or even by wagon. The elephant-train would be the precursor of the railway, which will certainly be constructed before the present century ends. Colonel Grant even laid before the Geographical Congress at Brussels the route of a line of telegraph extending from Khartoom, where the line from Cairo terminates, to Delagoa Bay, to which the line from the Cape already extends.[1] The line would ascend the Nile, and follow the shores of Lakes Victoria and Nyassa, and Colonel Grant, who is familiar with the country, is certain that it would meet with no insurmountable obstacle.

But the question arises, "What is the use of all these efforts? Can Central Africa ever be effectively won for civilization? Can the European live in that climate? and will the natives ever submit to the regular toil which is the condition of economic progress?" In the first place, we have still to explore in the centre of Africa a vast region, altogether unknown, which is a blank in our maps, and which comprises about 4,000,000 square kilometres, or more than seven times the area of France. Its frontiers have been determined by the expeditions led by Barth, Rohlfs, and Nachtigal, on the north; Schweinfurth, Baker, Gordon, Gessi, and Stanley, on the east; Cameron and Livingstone on the south; and Tuckey, Du Chaillu, Güssfeldt, and Compiègne, on the west. One of the principal objects of the Brussels Congress was to devise the means of penetrating this *terra incognita*. But the whole region of the great lakes has been already explored with sufficient care to enable us to form some idea of the future reserved for efforts at civilization.

To reach the great lakes let us follow the route now protected by Colonel Gordon, whom the khédive the other day named Governor of the Province of the Upper Nile, with residence at Khartoom. Leaving that town behind and ascending the river, we quit the region of perpetual drought and enter a region where the equatorial rains cover the soil with the most luxuriant vegetation. Crocodiles and hippopotami abound in

[1] "Remarks on a Proposed Line of Telegraph, overland, from Egypt to the Cape of Good Hope." By K. Nicholls, Esq., E. Arnold, Esq., and Colonel Grant, C. B.

the waters; lizards, serpents, monkeys, and buffaloes, in the forests. The river-banks are concealed by a dense growth of gigantic papyrus, and by the ambatch, the wood of which, says Schweinfurth, is as light as a feather. Between the wooded areas lie vast savannas, dotted with termite hills and the cabins of the Shillook negroes. From the Giraffe River to the White Nile, or from the seventh to the ninth degree of latitude, there is nothing to be seen but a boundless swamp. The warm, stagnant water is filled with papyrus and ambatch, and covered with floating isles of water-plants. Mosquitoes swarm here, and the sluggish air, laden as it is with swamp miasms, causes fever and dysentery. As we approach Gondokoro the land rises and mountains begin to appear; the river flows between rocky banks, in which the gneiss predominates. The aspect of the country is entirely changed; we are now entering the inhabitable portion of Central Africa. The country of the Niam-Niam, of Mombottu, of Madi, of Unioro, and of Uganda, where reigns the famous King M'tesa—in other words, the whole region to the north of Lakes Victoria and Albert—is a veritable earthly paradise, if we are to believe the accounts given by travelers. Mighty trees—palms, figs, acacias—form lofty vaults, in whose shade flow countless rivulets. So active is vegetation here that in the course of two years a dense thicket is to be seen in the clearings made by the natives by burning down the timber. Cameron describes sycamores in the shade of which five hundred persons encamped; and the baobab, the mammoth of the plant kingdom, also attains enormous proportions. Nature never rests. The vertical sun and the unfailing abundance of water enable the plants to grow unceasingly, and to produce flowers and fruit at all seasons. In the equatorial region rain falls regularly every month in the year, and in the southern zone, as far as the seventeenth degree, it rains in summer just as in winter.

The altitude of the central plateau, which varies from 600 to 1,300 metres (Victoria N'yanza is 1,120 metres), moderates the heat, cools the air, banishes miasma, and favors the growing of the products both of hot and temperate climes. The cereals of Europe grow here, as well as the sugar-cane, durah, and rice. Spices of all kinds, oils, resins, coffee, cotton, dyeing-plants, as garance and indigo, a great variety of medicinal plants, lumber of the best quality, the banana, fig, date, orange, even the vine—all these are produced here. Of mineral products we find gold, iron, and, more important still, coal, which crops out abundantly in various places. The climate resembles that of the Himalaya sanitariums. It seems to be less enervating than the climate of Java; the latitude is the same, but the African plateau is more elevated, and therefore less hot; yet in the coffee districts of Java, among the hills, the Hollanders live and multiply, nor does the death-rate exceed to any appreciable degree the death-rate of Europe. Those explorers of Africa who succumbed to disease were carried off by the fevers of the low-lying regions of the coast, and of the marshes of the interior. Those who have traversed the lake plateau, as Livingstone, Speke and Grant, Baker, Stanley, Cameron, Gessi, did not there contract any fatal disease, though exposed to privations and climatic conditions which in Europe would have broken down the strongest constitution, such as lying on the damp ground, wearing wet clothing for weeks, taking food irregularly, often eating food that was unwholesome or insufficient in quantity. Suppose a colony of whites settled at an altitude of 800 or 1,000 metres, occupying good houses and supplied with all necessaries they will surely enjoy better health there than they would at Calcutta, Bombay, Singapore, or Batavia, or even in the island of Bourbon, or in the Antilles.

A moment's reflection suffices to discover the magnificent future that awaits the colonies which, before long, will be established in Central Africa. Whence comes the wealth of the Southern States of the American Union, of Cuba, of San Domingo and Brazil? It is produced by turning to account the amazing fertility of a soil fecundated by the rays of the equinoctial sun, and employing the labor of a race inured to the burning climate. In those countries, however, the cultivation of the soil had two very disagreeable aspects: on the one hand the slaves labored only under compulsion, and hence their work was ill-done; and again the laborers commanded a very high price. Transfer the same enterprises—as the cultivation of sugar-cane, cotton, coffee, or tobacco—to the interior of Africa, and how much more favorable are the conditions! The land is more fertile, and vegetation incomparably more vigorous. The laborer is there already, and has not to be transported over sea at great cost, or reduced to slavery. The natives are a laborious race, obedient, intelligent. Already they carry on with success all manner of agricultural work. Their wealth in cereals and in cattle is very great, despite the chronic state of insecurity. They know how to smelt copper and even iron, forging arms and utensils of very good quality. The arts

of tanning hides, of spinning, weaving, mat-making, cotton-dyeing, are widely diffused among them, and many of their products are remarkable for their fineness and strength. The negro is but poorly endowed with the inventive faculty; but he learns quickly, and, when directed by Europeans, he is hardly inferior to our own laborers and artisans. The really dreadful trials endured by the carriers employed by Grant, Stanley, and Cameron, show that they readily undergo the greatest toil in consideration of a recompense that is often ridiculously small. The energy displayed by Livingstone's servants, when they carried down to the coast the body of their master, embalmed in salt, shows that they are capable of a devotedness bordering on heroism. Hence, agricultural and manufacturing industry would find here ready to hand all the necessary raw material, cheap labor, and coal for mechanical motors; and production would go on under conditions infinitely more favorable than are to be found in countries where slavery still exists in the transition state, as in Cuba and Brazil, or where coolie labor is employed.

Central Africa, which till lately was supposed to be a hopelessly barren region, on the contrary presents, in its atmospheric phenomena, its fauna and its flora, an exuberance of life and force unequaled in India or Brazil. The quantity of water which here falls to the earth is greater than in any other region. The sun, in passing alternately from one tropic to the other, produces over this region a zone of clouds from which are precipitated fertilizing showers of rain. The result is a vegetation resembling that of the Carboniferous period; and as was the case in those remote geological ages, the great herbivores—elephants, rhinoceroses, hippopotami, the last survivors of the ancient world—here abound. The quantity of ivory exported from Africa represents an annual destruction of 30,000 elephants. In its hydrographic features, too, this region is unparalleled anywhere on the globe. In order to form some idea of the hydrography of Central Africa, let us in the first place glance at the great lakes.

On quitting Lado, in latitude 5° north, and ascending the Nile, we pass through a mountainous region, which gives to the stream the Arabic name it here bears, Bahr-el-Djebel—the river of the mountains. Rapids in the stream interrupt navigation in the vicinity of the Egyptian station of Duffli. Above Duffli, in a vast fissure extending southward as far as Lakes Tanganyika and Nyassa, lies Lake Mwootan, which the English have named Albert N'yanza, after the late prince consort. According to the recent explorations of the Italian engineer Gessi, Colonel Gordon's lieutenant, this lake is situated at an elevation of 670 metres. It is about 220 kilometres in length, and from 35 to 90 kilometres in width. On the east it is bounded by the heights of Unioro, vertical cliffs of granite, gneiss, and porphyry, attaining an elevation of 300 metres, and on the west by the Blue Mountains, whose peaks rise 1,800 metres above the surface of the lake. Lake Albert lies so low within its rocky shores that most of the rivers which enter it form magnificent waterfalls. Toward the south it terminates in a vast swamp, which Gessi was unable to penetrate. But toward the north that traveler made a discovery of very great importance, if his conjecture should happen to be correct. Just at its exit from the lake the Nile bifurcates, one branch taking a southwesterly direction. This branch is supposed to be the Iei or Ayi, which, after flowing through the country of the Niam-Niam, rejoins the main river at the point where it forms the marsh of floating islands. If this is so, it might be possible to escape the rapids at Duffli, and establish an unbroken line of navigation from the Mediterranean to the Albert N'yanza. This would be of incalculable advantage for commerce and for civilization. In consequence of the almost entirely pacific annexations effected by Sir Samuel Baker and Colonel Gordon, Egypt now extends as far as Lake Albert, and thus becomes one of the largest empires in the world. From the foot of this lake to Alexandria is a distance of about 30° of latitude, or 3,000 kilometres. This is equal to four times the length of France from Dunkirk to the Pyrenees.

Some 40 miles in a straight line from Lake Albert lies the Victoria N'yanza, or Ukerewe, the great inland sea of Africa. Its superficial area is 84,000 square kilometres—equal to the area of Switzerland, with Lombardy and Venetia. Lake Victoria is dotted with large islands. On the west it is bounded by the Alpine region of Uganda and Karagwe, which divides it from the Albert N'yanza, and on the east by Ugejeia and Ururi. To the north lies the country subject to King M'tesa, whose capital, Dubaga, occupies an admirable situation overlooking the blue waters of Murchison Bay. M'tesa has always kindly received the European travelers who have visited him, and has even made a request for missionaries and artisans to introduce among his people the civilization of Europe. Nevertheless, I have heard it asserted by the Marquis de Compiègne—the other day so unfortunately slain in a duel at Cairo—

that M'tesa treacherously procured the assassination of Linant de Bellefonds at the hands of the escort assigned to him by the king himself. The two great lakes are connected by a river which may be regarded as a continuation of the Nile, and which hence gets the name of the Victoria Nile; but owing to a difference of 450 metres between the altitude of Lake Albert (670 metres) and that of Lake Victoria (1,120 metres), this river is not navigable. Just below its exit from Napoleon Bay it forms the Ripon Falls and the Isamba Rapids. After receiving an affluent, the Luadcherri, which has its source in a vast swamp, it traverses Lake Ibrahim, discovered by Long in 1874. Farther down it receives the waters of the Kafoor, which flows from the mountains of Uganda, and soon it passes between steep banks. Below the Falls of Karuma it forms eight rapids or cascades within a length of 30 kilometres. Finally, before entering Lake Albert, it has a precipitate fall of 20 metres. This fall, known as Murchison Fall, surrounded as it is by a luxuriant vegetation, and commanding a view of the beautiful lake as far as the Blue Mountains, forms, says Baker, the most wonderful landscape imaginable.

There is no longer any doubt that the Victoria N'yanza, and not the Tanganyika, is the upper reservoir of the Nile; but which one of its many affluents can lay claim to being the true source of that stream? At one time it was supposed to be the Kadjera, which forms two Alpine lakes, Windermere and Akenyara, and which has its origin in the elevated plateau of Uzinza. But now the true source of the Nile is supposed to be the Shimyu, which comes from the south and pours into Speke Gulf, in the southeast corner of Lake Victoria, a volume of water greater than that of the Kadjera. One degree south of the line lies, midway between the two great lakes, the mountainous region of Ankori and Ruanda, recently visited by Stanley; it is a remarkable country. The ever-verdant valleys are constantly watered by innumerable torrents, and the peaks of the mountains rise to an elevation of 4,000 or 4,500 metres. Here we find the bold crags of the Alps and the beautiful landscapes of the Tyrol beneath the blaze of an equatorial sun; here are combined the life-giving air of high stations in Europe and the equable climate of the equinoctial zone. Nothing more can be desired for sustaining health and the capacity for toil, and hence a population of European origin might easily live and thrive in this climate.

Just below Lake Albert, in latitude 3° south, lies Lake Tanganyika, discovered in February, 1858, by Burton and Speke. Like Lake Como, it resembles a great river, its length being 670 kilometres, while its width in some places is not over 20 or 30, and in no place is it much over 100 kilometres. Its area is 37,000 square kilometres, or about half the area of the Victoria N'yanza. Lake Tanganyika is situated in a prolongation of the fissure in which lies Lake Albert, and, inasmuch as it is some 150 metres higher than Lake Albert above sea-level, Livingstone and Grant supposed that it emptied into the latter lake, and thus was the true source of the Nile. Tanganyika is fed by over 100 streams, most of which have a rapid fall as they enter it, owing to the abrupt rise of its shores. In 1871 Livingstone and Stanley carefully inspected the northern end of the lake, expecting there to discover the supposed exit of the Nile. But, instead of an outlet, they found a small stream, the Ruzizi, carrying into Tanganyika the waters of Lake Kiro. Thus the problem was solved: it was seen that Tanganyika does not belong to the Nile basin; but then what becomes of the surplus water of the lake? This question was settled in 1873 by Cameron. Having surveyed all the bays and affluents of Tanganyika, he discovered at about the middle of the western shore a river, the Lukuga, which, instead of entering the lake, forms the exit for its waters. So abundant was the aquatic vegetation in this stream, that he was unable to follow its course in his boat; but, nevertheless, while making his way to Nyangwe, he found that this outlet of the Tanganyika falls into a great river, the Lualaba, which is in all probability identical with the Congo or Zaire. This mighty river is also fed by a number of other lakes situated in the same region, namely, Lake Bangweolo, on whose shore Livingstone met his death, Lake Mero, Lake Kamalondo, Lake Kassali, described by Cameron, Lake Langi, and Lake Sankorra.

At only a little distance from the southern extremity of Lake Tanganyika, but 200 metres lower, commences Lake Nyassa, which fills the same fissure, for it has much the same breadth and the same north-and-south direction, with a slight bend to the east. Nyassa being only one-half as long as Lake Tanganyika, its area is only about 1,500 square kilometres. It empties into the Zambesi through the Shire, whose course, lying through a mountainous region, is highly diversified. Lake Nyassa, being situated at no great distance from the Mozambique coast, is more accessible than the other lakes. It is on its southern shore that the Scotch Missionary Society have founded their station of Livingstonia, a place

enjoying its full measure of prosperity; there is even a little steamboat for navigating the lake and checking the slave-trade throughout this whole region. Then there are Lakes Baringo and Manyara, the one lying north, the other south of Kilimandjero and Kenia, whose snowy peaks attain an elevation of over 6,000 metres. In no other portion of the globe do we find so many inland seas, every one of which is admirably fitted to become a centre of civilization. It is a second Switzerland, but with gigantic proportions. Even in antiquity it was known that the Nile had its source in lakes situated in the heart of the continent. Marinus of Tyre and Claudius Ptolemy, who lived in the second century after the Christian era, learned from Arab traders of the existence of two lakes, whose site they fixed in the parallel of the island of Menuthias, now Zanzibar —a very precise determination of its true locality. The "Tabula Alinamuniana," of the year 833, and the chart of Abul Hassan, of the year 1008, indicate two lakes; while the "Tabula Rotunda Rogeriana," of 1154, and the chart of P. Assianus, show three lakes answering closely enough to Lakes Albert, Victoria, and Tanganyika;[1] but it is only within the last twenty years, thanks to the discoveries of Grant, Burton, Speke, and Livingstone, that we have been enabled to demonstrate the exactitude of these ancient indications. Geographers were beginning to call them in question, and compilers of maps who were sticklers for positive data left the whole central region of Africa blank.

From this central plateau, so admirably constituted from the hydrographic point of view, descend some of the mightiest rivers on the globe. From its source to the Mediterranean the Nile measures 3,900 kilometres in a straight line, and hence its actual length is greater than that of the Mississippi or the Amazon. It is a most singular river: in its upper portion it branches out in all directions, and is fed by innumerable lakes and affluents; then, after receiving in Nubia the Atbara, which comes down from the high land of Abyssinia, it courses through an absolute desert, without so much as a single rill bearing to it the tribute of its water. According to Schweinfurth's calculation, the river-basin of the Nile comprises 8,260,000 square kilometres, while that of the Amazon comprises only 7,000,000, and that of the Mississippi hardly 3,000,000; and soon Gordon's lieutenants will unfurl the Egyptian flag over this immense territory. The Congo surpasses the other rivers in the enormous volume of water which it pours into the Atlantic Ocean. At its mouth it is 2,950 metres wide, with the simply incredible depth of from 380 to 400 metres. Its current flows at the rate of 7 kilometres per hour, and its discharge (51,000 cubic metres per second) is so enormous, that the river becomes entirely lost in the sea only at the distance of 100 kilometres beyond the shore-line, and at the distance of 12 kilometres the water is still perfectly fresh. This discharge, which is 200 times greater than the flow of water in the bed of the Seine at Paris,[1] is nearly constant, a fact which appears to show that the river receives affluents from both sides of the line, drawing now upon those to the north, again on those to the south, as both are alternately swollen by the rains in their respective zones. The expedition of the brave and unfortunate Tuckey in 1816 resulted in tracing the Congo only as far as the Falls of Jelala, and since his time no one had penetrated any farther. The discoveries of Cameron now appear to have removed all doubt as to the identity of the Congo with the Lualaba, and hence its source must be the river Tchambesi in the Bemba country of Livingstone, situated between Lakes Nyassa and Tanganyika, and not far from the sources of the Nile.

The Zambesi is the third of the great arteries which descend from Central Africa. Its course was determined by Livingstone. It is not so long as the Nile, and it has a less volume of water than the Congo, but it presents more picturesque views. Issuing from Lake Dilolo, as the Leeba, it flows south, passing through the Makololo country, where it is known as the Leeamby, and then, after receiving the Chobe, which comes from the west, it reaches the granite plateau of the Batokas. Here, precipitating from a height of 450 metres, through a narrow rift in the rocks, its waters, which before had been spread abroad, it forms the famous cascade appropriately named by the natives Mosiwatunya, i. e., Thunder-Smoke, but for which Livingstone substituted the more trivial title of Victoria Falls.

[1] *See* the excellent summary of our knowledge concerning Africa by Dr. Josef Chavaune, in the *Mittheilungen* of the Vienna Geographical Society, "Central Africa nach dem gegenwärtigen Stande der geographischen Kentnisse," 1876.

[1] At low-water level the *débit* of the Seine is only 90 cubic metres per second: the mean *débit* is 250 cubic metres. On March 17, 1876, when the river was at its greatest height, it did not exceed 1,650 cubic metres at the Pont-Royal. To equal the Congo, therefore, we should have to combine 200 rivers like the Seine; that is to say, all the rivers of Europe taken together would hardly suffice.

Before it enters the Indian Ocean, between Quilimane and Sofala, the river contracts, traverses the Lupata Pass, and from the Shire receives the surplus water of Lake Nyassa. Finally, to the west of Lake Albert, in the Mombuttu country, Schweinfurth has discovered a mysterious river, the Welle, which, rising in the western slope of the Blue Mountains, is 250 metres wide, with considerable volume at no great distance from its source. Where does the Welle discharge its waters? Schweinfurth is of the opinion that it forms the upper portion of the Shari, which is the principal affluent of Lake Tsad, and, if such is the case, then this river might be of great service to commerce. But it may really be an affluent of the Congo, or the source of the Ogowai, the lower portion of which was recently explored by Compiègne and Marche,[1] while its upper portion is as yet entirely unknown. If it proves to be the source of the Ogowai, it must one day facilitate commerce with the vast unexplored region lying between the Gulf of Guinea and the great lakes.

According to Commander Cameron, commerce and civilization will find in the great rivers the easiest route to the central plateau; but, unfortunately, the African Continent has one peculiarity that is seldom found in other quarters of the globe, and which hinders regular navigation. At a very little distance from the coast the land rises abruptly to a great height, and the rivers, instead of wearing away for themselves a bed with gradual slope downward, descend in the form of rapids and falls. These obstacles would have to be overcome by portages, for which tramways might be advantageously substituted. Small steamboats of steel, with light draught of water, might thence carry passengers and merchandise into the heart of the continent. It would even be possible, says Cameron, to cross in this way from ocean to ocean, inasmuch as the Zambesi and the Congo both take their rise in the swampy flats of Lake Dilolo, and in the rainy season their sources are united. The whole region then resembles an enormous sponge; and the water-courses are so numerous that Livingstone counted thirty-two in a distance of one hundred and twelve kilometres. Cameron found ninety-seven water-courses entering Lake Tanganyika, many of them very considerable, and themselves made up of a number of affluents. The compacted meshes of this hydrographic network have been very aptly compared with the innumerable little blood-vessels that ramify beneath the epidermis of the human body. So great is the abundance of water that the rivers are navigable almost from their sources, and only a few leagues' length of canal would be required to connect the basin of the Congo with that of the Zambesi. The Portuguese Government has lately authorized the navigation of the last-named stream by steamboats, and the station of Livingstonia has a little steamer, the Ilala, on Lake Nyassa. If the Iei, the as yet unexplored branch of the Nile, is not broken by rapids, small, swift steamers can easily pass up from the Mediterranean to Lake Albert. Already, in January, 1876, Colonel Long transported in sections to a point above the Duffli rapids a steamer fifteen metres in length, and two iron vessels, and with these Gessi thoroughly explored Lake Albert. Toward the end of July, in the same year, another steamer first made the voyage from Duffli to Magongo, on the Victoria Nile, reaching the frontier of M'tesa's dominions on Victoria Lake. And, as Colonel Gordon, in the spring of 1874, made the journey from Cairo to Gondokoro in six weeks, it may safely be affirmed that even now we can, without any danger, reach the region of the great lakes from Egypt in two months.

Of overland routes, the one most frequented is that from Bagomoyo to Ujiji, on Lake Tanganyika. It is regularly traveled by caravans, dispatched coastward by the Arab traders in the interior. This is the route followed by all explorers starting from Zanguebar. It is the opinion of Cameron that a narrow-gauge railway of very light construction would not cost over 15,000 or 20,000 francs per mile, and that before long it would pay interest on the outlay. In the mean time, a very easy route might be opened by way of Lake Nyassa. The steamers at Livingstonia could carry explorers to the northern end of the lake. Thence ascending the little river Rooma, they would soon reach the sources of the Kirumbe, which empties into Lake Tanganyika. The distance between these two lakes appears to be not over thirty leagues. From the north end of Lake Tanganyika, by navigating the Ruzizi and Lake Kivo, we reach Lake Albert, only eighty leagues distant from the foot of Tanganyika. This is plainly the best route for a line of telegraph, which would be almost entirely submerged, and so protected from injury by the natives or by wild animals. But the true line of

[1] "Voyage dans le Haut-Ogoué, par le Marquis de Compiègne et A. Marche," in *Bulletin de la Société de Géographie de Paris*, 1874. Du Chaillu, Walker, and more recently Dr. Lenz, had, like M. de Compiègne, been checked by the cannibal tribes of the interior, at a short distance from the coast.

approach by which Central Africa might be uninterruptedly connected with the already settled regions of Southern Africa plainly lies through the Transvaal country, the plateau of Monomatapa, Tete on the Zambesi, and Lake Nyassa. The distance is about six degrees, or 150 leagues, through an elevated region, free from the fevers which infest the coast. A Frenchman, Dr. Émilien Allou, has, in fact, just made the journey from the South-African republic to the Zambesi, bringing back collections of great interest from the number of new species they embrace. Were the republic of the Boers to become a member of the Cape Confederation, England would have only to establish a few stations between the Limpopo and the Zambesi, and at once the tide of immigration, which is now enriching Natal, would begin to pour in from that side. In a few years the Anglo-Saxon influence would pervade Africa, and win for civilization the magnificent region of the great lakes. This peaceful conquest would be in no sense exclusive, for there is plenty of room here for energetic men of every nation.

Let no one imagine that this is all a dream. The future that awaits European stations in this region is assured by the success which has attended the founding of Arab posts in the interior. At Kazeh, in Unyanyembe; at Kawele, on the shore of Tanganyika; and at Kwakasonga, on the Lualaba, the Arabs have permanent residences. They live here in great comfort, owning large houses, herds, poultry, slaves. By the caravans which at stated times go down to the coast, they are supplied with coffee, tea, sugar, arms, and textile fabrics. Even in a far less accessible region, at Nyangwe, at a considerable distance beyond Tanganyika, Cameron found an Arab, Jumat Mericani, making exchange both with Zanguebar and Benguela, that is to say, with the coasts of both oceans.

The natives are extremely gentle and peaceful in disposition; and, though strangers seldom visit this country, save for the purpose of slave-hunting, and destroying and depopulating their villages, English travelers have nearly always been able to procure provisions at the ordinary prices. If travelers have been robbed, it has nearly always been by their own carriers. Husbandry is very well understood, and conducted with care, the men laboring in the fields nearly the entire day. When the country is not wasted by war, the population increases, and the jungle is quickly cleared away. A noteworthy instance of this is cited by Cameron. In 1857, when Burton and Speke were on their way to the interior, on the journey which resulted in the discovery of Lake Tanganyika, they experienced great difficulty in traveling through the Mgunda-Mkali country. There was a lack of water, the jungle was almost impassable, and many of their carriers perished in the effort to make their way through it. When Cameron visited this region in 1873, everything was changed. A tribe of the Wanyamwesi, driven back by local wars, had settled here. In the heart of the forest they had built villages, had dug wells, and had converted the jungle into well-cultivated fields. The appearance of the country was delightful, resembling an English park. Hence European settlements would here find in abundance the necessaries of life; and if, as their numbers increased, they were to render less frequent those wars between tribe and tribe, which now desolate the country, progress would be assured, and the well-being of the people would be augmented rapidly.

Another instance of the success which awaits the colonist in these regions, long regarded as inaccessible, is supplied by the adventures of M. Bonnat, as lately rehearsed by him at a meeting of the Paris Society of Geography. In 1860, Bonnat was a member of an expedition commanded by Captain Charles Girard, who had resolved to ascend the Niger. Girard having abandoned this enterprise, M. Bonnat, by himself alone, penetrated into the interior of Guinea, and there entered on a very lucrative business career. The village in which he lived was attacked by the Ashantees. Carried away to Coomassie, he was treated very harshly, as were also his two companions in captivity—a German and his wife. Soon the king conceived a liking for Bonnat, and took him into his favor. There he spent five years, experiencing all manner of kind treatment. He learned the language of the natives, and found that they carried on an extensive trade with a large town in the interior, Salaga, which is in commercial relations with the Sahara, and even with Tunis. When the English made war on the Ashantees, the king determined to put Bonnat to death. He was made fast to a tree, and was on the point of being beheaded, when, as luck would have it, the marines entered Coomassie. In 1874 he again set out for Africa, intending to settle at Salaga, of which town he had heard such wonderful stories. He succeeded in ascending the river Volta, despite its rapids, and in overcoming the objections made by the native chiefs; thus he has opened a new route for commerce. He was the first European to visit Salaga, a city of over 40,-

000 inhabitants, situated in Upper Guinea, back of Dahomey and the Ashantee country. Here he has established an exchange, and made considerable profits. He buys ivory for one franc 20 centimes per kilogramme, and sells at the rate of 730 francs per ton salt, the price of which in Europe is 50 francs. Gold-dust, from which the Gold Coast derives its name, is here abundant in the river-sand. M. Bonnat has returned to Europe, in order to obtain improved apparatus; he will soon go back, taking with him M. George Bazin, son of the inventor of the ingenious dredge employed in recovering the coin from the famous Spanish galleon sunk in the bay of Vigo. M. Bonnat has never suffered from disease during his stay in Salaga, for he has used the same dietary as the natives; and yet the climate of Guinea is more unwholesome than that of the lake-region.

The slave-trade is the great scourge of Africa. To procure slaves, regular man-hunts are set on foot. The Arab traders in the country lying near the coast of the Indian Ocean and the Portuguese half-breeds of the Atlantic coast carry on this system of man-hunting, with the aid of the native chiefs. The latter sell their own subjects, or attack neighboring tribes, in order to procure cottonades, glass beads, or arms. The result is frequent wars of extermination. The man-hunters fall upon a village, slay all those who make resistance, and carry off all that have not made their escape—men, women, and children. Some of the captives are sent down to the coast, or transported to Egypt or Arabia; others are sold at various markets in the interior, for employment in the fields or in domestic service; others, again, serve as a medium of exchange—as actual money. Throughout the entire region between the coast of Congo and Lake Tanganyika the price of commodities is estimated at so many slaves, just as formerly in Europe it was estimated at so many head of cattle. Again and again was Cameron unable to obtain what he wanted simply because he did not possess the one form of money which the people would accept by way of payment. Traders visit the regions where ivory is abundant, and make payment for their purchases in slaves. In order to get back from Nyangwe to Benguela, Cameron was obliged to travel in company with Portuguese half-breeds, who were leading herds of these unfortunate people in the direction of Bihe.[1]

In proportion as commerce penetrates into the interior, and the chiefs learn to have new wants, the slave-trade develops and calls for a larger number of victims. For every ten slaves that reach their destination, a hundred lives are lost in the attack upon the village or on the route. To escape from the slave-hunters the natives flee from their homes, conceal themselves in the jungle, and return to the savage state. Cameron fell in with this unfortunate class of people everywhere in the woods bordering on Lake Tanganyika. Livingstone has drawn a striking picture of the ravages wrought by the traffic in slaves. In 1851, when he visited the region of Lake Nyassa, he found there a dense population, industriously cultivating a fertile soil, and living in great comfort. The climate was so mild, and the natives so gentle, so industrious, that he conceived the idea of here settling the colony which later was actually founded here, and which bears his name. Ten years afterward, when he passed through this same country, he could not recognize it. The villages had been burned down and the fields abandoned; the people were gone—slaughtered, carried away, or hid in the jungle. The water-courses were still choked with corpses, and on the trees hung the bodies of women that had been horribly mutilated. During the last years of his life, Livingstone was ever haunted by these horrible sights.

"In endeavoring," he wrote, shortly before his death, "to give an account of the slave-trade in Eastern Africa, I have had to keep far within the limits of the truth, for fear of being charged with exaggeration; but it were impossible to overstate its cruelty and the evils resulting from it. The spectacle that I have witnessed, though it included nothing save the every-day incidents of this traffic, was of so revolting a character that I am forever striving to efface it from my memory. At times I succeed in forgetting the painfulest of my recollections; but often the dreadful scenes at which I have been present rise up before my eyes in spite of all that I can do, and cause me to start out of my sleep with horror at the dead of night."

[1] This statement of Cameron's has called forth a strong protest in the Portuguese Chambers from Senhor Texeira de Vasconcellos and Senhor d'Andrade It would be the height of injustice to hold the Portuguese Government answerable for the horrible crimes committed by half-breeds, and even by negroes who call themselves Portuguese because they have learned a few words of the Portuguese language during their stay in the coast towns. In the late lamented Marquis de Sá da Bandeira's "O Trabalho Rural Africano," we may read of the measures taken with a view to secure equal rights to all natives in the Portuguese colonies. As was very eloquently demonstrated by Senhor Texeira, his country has passed laws quite as humane as those of any of the countries which assume to lecture Portugal now. Nevertheless, the governors of the Portuguese colonies in Africa might take greater care to prevent an abuse of the national flag in covering a hateful traffic, and one severely prohibited by law.

"Africa," says Cameron, "is bleeding at every pore. A country of unparalleled fertility, needing only labor to make it the foremost productive country on the globe, is depopulated by the slave-trade and the massacres which attend it. If nothing occurs to put a stop to these wars of extermination, the land will become a wilderness utterly impenetrable to traders and travelers. It is a disgrace to the nineteenth century that such horrors can go on. It is unaccountable that England should let slip so favorable an opportunity of opening for her products so important an outlet."

In Berlioux's conscientious work, "La Traite Orientale," we learn that this odious traffic has two other centres besides the regions south of the equator. These are, in the first place, Soodan, whence slaves are sent to the great mart of Kooka in Bornoo, and thence to Moorzook, the capital of Fezzan, and so on into Tunisia and Tripoli; in the second place, the Upper Nile. The cruelties practised in this region have been described by several European travelers, and latterly the Egyptian authorities at Khartoom have been justly charged with favoring the slave-trade. Arab merchants and European adventurers would enter the country of the Shillooks, the Dinkas, and the Djours, penetrating as far as Gondokoro, under the pretense of hunting elephants and buying ivory. They would have under their command a band of two or three hundred well-armed miscreants, and would establish a *seribah*, or intrenched camp. From this basis of operations they would make raids upon the surrounding tribes, which could make no effectual resistance. Baker estimated the mean animal profit of each *seribah* at 450 slaves. The slave-hunters received from their employers a fixed payment in the shape of slaves. It is estimated that even quite recently 30,000 negroes were annually carried away out of this region alone, and distributed throughout the Mussulman territories. This would presuppose a loss of 200,000 human lives. The total number of unfortunates reduced to slavery or butchered during the raids must be considerably over half a million.

Happily, two recent events encourage the hope that the slave-trade will cease throughout the entire western half of the African Continent. On setting out for Khartoom, there to assume command of all the Egyptian forces on the Upper Nile, Colonel Gordon announced his determination of putting an end, cost what it might, to this traffic, and there is no doubt that he will succeed, provided his life is spared. It will be remembered that in 1873 Sir Bartle Frere, at the head of an English flotilla, exacted from the sovereign of Zanguebar a promise no longer to tolerate the sale and exportation of slaves in his dominions. After this the trade was carried on by the way of Kilwa; but Dr. Kirk, consul-general of England, recently obtained from the sultan the issuance of a proclamation prohibiting the equipment of any caravan destined to engage in the slave-trade, and threatening with confiscation any such caravan coming down to the coast. And, as the edict was rigorously enforced, bands of captives, already *en route*, had to be taken back into the interior. Money-lenders refuse to risk their capital in enterprises whose results are so precarious. One expedition, involving a million francs, proved to be a total loss. Thus, for the time being, the slave-trade is suspended along the Zanguebar coast.[1] According to a private letter, written by the gallant Captain Young, commanding at Livingstonia on Lake Nyassa, unlooked-for results have been obtained. Ten thousand slaves used annually to pass by the southern extremity of the lake on their way coastward. In 1876 only eighty-eight of these wretches reached their destination by this route. If by these energetic measures the traffic can be rendered so risky as to be unprofitable, the Arab traders will probably abandon it; but, as is very justly observed by Mr. Waller, great danger will hence result to ulterior relations with the heart of Africa. The native chiefs and Arab traders in that region will find themselves suddenly deprived of the means of procuring cottonades, glass beads, arms, and other commodities, which they were wont to purchase with slaves. They cannot buy all they want with ivory and tobacco alone. They will be enraged on seeing their commerce annihilated, and it is highly probable that they will try to revenge themselves on travelers and missionaries, on whom they will lay the blame of suppressing the traffic in slaves. The only means of escaping from this peril is to be found in the idea proposed by the King of the Belgians, of exchanging European goods for the agricultural products of Central Africa. The majority of the chiefs, we are assured by Mr. Waller, very well understand that man-hunting and the massacres thence resulting are ruining their dominions, and they would gladly see regular commerce taking the place of the odious traffic in human beings.

[1] These details I take from an interesting letter lately published in English newspapers by Mr. Horace Waller, who has spent several years in Zanguebar and in the interior of Africa.

But, even in the present state of things, commodities for export would not be lacking if the cost of transportation were not so heavy. Where everything must be carried on the backs of men, the only products that can profitably be transported to the coast are ivory, gold, gums, or slaves, who are their own carriers. With steamboats, a tramway, or an elephant-express, commerce would develop to an extraordinary degree. Cameron, in the concluding chapter of his book, enumerates the chief products that might be exported; these are: Sugar, for the sugar-cane thrives wherever there is not lack of water; cotton, which is cultivated everywhere, and which grows wild in sandy districts, especially in Ufipa; palm-oil, which is abundant in the whole Lualaba basin up to an elevation of 700 metres; coffee, which grows spontaneously in Karagwe and elsewhere, producing a bean of the same size and flavor as Mocha; tobacco, everywhere cultivated on a small scale, that grown in Ujiji being of the very best quality; sesame and castor-oil, spices of every kind, sorgho, copal, caoutchouc, maize, bananas, hemp, wax, hides, copper, gold, cinnabar, and silver. Such are the chief products already exploited by the natives, to say nothing of others which the European would soon discover and turn to account. M. Bonnat's experience goes to show the chances of success which await the man of enterprise who, backed by the International Exploration Society, should take up his abode in this magnificent country.

One-hundredth part of the effort made in conquering India would suffice to found here an empire larger, more productive, less costly to administer, and less exposed to outside competition. The virgin soil of Central Africa possesses a fertility very different from that of Hindostan, now impoverished by thousands of years of exhaustive husbandry. Being regularly and far more abundantly watered by the equinoctial rains, it is never exposed to those droughts which periodically cause such cruel famines in the provinces of India. The negro is a far more able-bodied agricultural laborer than the Hindoo; and, wherever there exists a small measure of security, the population rapidly increases, and hands are in plenty. In the whole region of the great lakes the villages touch one another; the land is cultivated with great care, and the laborers are better fed than the rural population of Europe. Hence there might be developed here an outlet for our manufactures greater than India and Australia taken together.

The most pleasing feature of the plan devised by the Brussels Congress is, that it does not propose to conquer Central Africa by force in the interest of any one power; but to bring that immense region into the current of civilization, for the benefit of mankind in general, by peaceful means and by the development of commerce. The organization of the society founded at Brussels, and the noble words pronounced by King Leopold when he inaugurated the enterprise, clearly show its international character. At its head is an executive committee, consisting of a president—the King of the Belgians himself—and three other members, namely, M. de Quatrefages, representing France; Dr. Nachtigal, Germany; and Sir Bartle Frere, England. To these will be added two delegates for each national committee, appointed in the different countries. The mission of these national committees is to bring the programme of the society into public notice in their respective countries; to collect subscriptions, and to suggest to the international committee plans for the judicious employment of its funds. In Belgium the national committee was formed immediately, under the presidency of the king's brother, the Count de Flandre. Thanks to the warm attachment of the people for their sovereign, subscriptions have come in freely. Most of the departments of the government, the officers of the army, the civic guard, the criminal and provincial councils, the functionaries, the industrial establishments, have contributed their mites. The sum already collected is sufficient to yield an annual revenue of 124,000 francs — enough to defray the expense of an expedition every year. Had not the industrial crisis considerably reduced the income of the whole people, the subscriptions would have been larger; and, besides, the enterprise is still only in its initial stage. In Germany the national commitee has been formed under the auspices of the prince imperial, and its president is the Prince von Reuss. In England the "African Exploration Fund" has been placed under the patronage of the Prince of Wales. Portugal, the home of great navigators, will not be indifferent to this work, for her fearless travelers, the Pombeiro brothers (1806–1815) and Silva Porto (1853–1857), have already traversed Africa from the Congo coast to Mozambique, and she owns the ports that will be the principal outlets for African commerce. A committee is in process of formation, under the patronage of the Lisbon Geographical Society and the Minister of the Colonies. An important *rôle* seems also to be reserved for Holland, whose sons colonized the Cape, and founded the two free states of the

Oranje-Staat and the Transvaal, which are destined to form the connecting link in the chain of posts yet to be established from Cairo and Khartoom down to the extremity of Southern Africa. The Netherlands committee has been constituted under Prince Henry of the Low Countries. The Austrian committee has for its president Baron von Hofmann, Minister of Finance, under the patronage of the prince imperial, the Archduke Rudolf. The Italian committee is in process of formation, under the presidency of the heir-apparent. The French committee is being formed under the direction of the Admiral La Roncière Le Noury, the Paris Society of Geography coöperating.

A Society for the Exploration of Africa has been founded at Madrid, under the presidency of the King of Spain, in conformity with the programme of the Brussels Congress. Judge Daly is engaged in forming a national committee in the United States; and M. Bouthillier de Beaumont, President of the Geographical Society of Geneva, has announced that a committee will be formed in Switzerland. Finally, the King of Sweden, the King of Saxony, the Grand-duke of Baden, the Duke of Saxe-Weimar, the Grand-duke Constantine of Russia, the Crown-Prince of Denmark, and the Archduke Carl Ludwig of Austria, have accepted the title of honorary members of the international committee. Thus have the sovereign houses of Europe given at least the support of their names to the work, and even the Sultan of Zanguebar has written to the King of the Belgians to the effect that his coöperation might be counted on.

It is to be wished that every nation in Europe may enter heart and soul into this holy crusade of civilization against barbarism and the trade in human beings, at the very moment when the rivalries of the respective governments threaten momentarily to place them at enmity with each other in spite of themselves, and though they desire only to labor in peace. At the Brussels Congress the representatives of the various nations extended the hand to one another, forgetting all animosity and every old grievance, and devoting themselves to labor in common for a noble object. Would it not be an admirable confirmation of the great principle of human brotherhood if, in the clash of arms and amid the preparations for war, there were to spring up and develop an international association appealing to the kindly feelings of the people of our continent for the means of bestowing on the wretched inhabitants of a neighboring continent order, security, and liberty—of suppressing the slave-trade, and of introducing among them the blessings of modern civilization? Would it not also be the most telling and, at the same time, the most honorable protest against that policy of mutual jealousy and distrust whose upshot must be to join in a general *mêlée* nations that ought to have but one aim—namely, to diffuse throughout the whole world the principles of justice revealed by Christianity for the enfranchisement and happiness of all mankind?—*Revue des Deux Mondes.*

THE CONTEST OF HEATHENISM WITH CHRISTIANITY, AS REFLECTED IN GREEK AND ROMAN LITERATURE.

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THE great preacher of Christianity to the heathen, the Apostle Paul, calls his preaching of "Christ crucified, unto the Jews a stumbling-block, and unto the Greeks foolishness;"[1] and thereby gives a concise and striking definition of the point of view from which the opposition of the two sections of the non-Christian world, whom he had gone forth to gain, chiefly proceeded. To the Jew, Christianity, even when hostile to him, was to a certain extent intelligible, for it was rooted in monotheism and in the Messianic hopes of his nation But the heathen, or, as Paul calls them, the Greeks, were absolutely without the assumptions with which it found points of contact in the Jewish world. Its monotheism placed it in undisguised enmity to the polytheistic national religion; and, on the other hand, to those who might have been disposed to adopt monotheism as such, the doctrines which had grown out of the Jewish belief in the Messiah must have been all the more unintelligible. The worship of a Jew who had suffered the disgraceful death of malefactor; the belief that he still lived in heaven; faith in his divine origin and nature; the expectation that he would come again with the hosts of heaven to put an end to the existing

[1] 1 Corinthians i. 23.

state of things and the kingdoms of this world; the hope of a future resurrection of the body —how could this faith and these expectations appear to any cultivated Greek, at first sight, as anything but extreme folly, the offspring of fanatical phantasy, or as downright imposture? Add to this the peculiarities of Christian life and manners; the way in which the party held together, which to an outsider conveyed the impression of a secret society, a conspiracy against the established order; the anxious care with which all contact with the heathen world was avoided, which could but lead to entire withdrawal from all non-Christian society; the aversion to military service and public offices; the principle that Christians should settle their disagreements among themselves, and not go to law before heathen courts; the refusal to take part in public festivals and rejoicings, and in the sacrifices for the empire and emperor: add to this the contempt which an educated Greek or distinguished Roman was sure to feel for a society which was for a long time mainly recruited from the people, in which artisans, slaves, and freedmen, associated on a footing of equality and fraternity with the few of the upper classes who entered it, in which, to say the least, no value was placed on the artistic adornments of life, scientific, æsthetic, or social culture, the deeds of the warrior, or the fame of the *savant*—when we realize all this, we cannot wonder that the friends of Hellenic art, the pupils of the Attic philosophy, the sons and heroes of imperious Rome, could not take to a religion which presented itself in a form so repugnant and incomprehensible.

In reality, this religion was not without numerous and profound relations to the mental tendencies, the modes of thought, and the needs of the age. Indeed, Christianity was a product of the age, a result of the spiritual forces by which it was actuated. Neither did the conditions of its rise and progress lie exclusively in Judaism. It was not until Judaism had come into wide and permanent contact with Hellenic culture, and had been fertilized by it in many ways, that Christianity could be developed from it. As the world-wide empires of Alexander and the Romans prepared the way for the religion of the world by an entire revolution in political circumstances, so was its most essential inward condition contained in that doctrine which, chiefly through the influence of the Stoic philosophers, had for centuries attained wide circulation the doctrine that all men form one great commonwealth, that they have equal rights and duties, that they are only separated from each other by their moral conduct, that they are all subject to the same natural and moral laws. The high moral demands of Christianity were in unison with what had been taught by the most eminent of the sages of old.

As Paul placed value on faith alone, so did the Stoics on moral sentiments, virtue, and wisdom; if the former could not paint in colors too glaring the universal depravity of mankind, we find similar descriptions among his Roman contemporaries, and especially by the Stoic Seneca; if the Christians divide all mankind into the regenerate and unregenerate, the Stoics class them not less strictly as wise men and fools; if the Christians look beyond this world to the glories of heaven, the Stoics rejoice no less in the "birthday of eternity," which even they call the day of death, in deliverance from the bondage of the flesh, the entrance on "the great eternal peace."

Many other points might be mentioned in which Christianity met the deepest needs of the time, had an affinity with its best aims, and with movements which had long been widely spread; and it might have been expected that among those who, like it, recognized the moral depravity of the age, and sought to correct it with an earnestness and devotedness which we cannot but admire, it would have been justly estimated. But it was not so. The Christians, in their estimate of the Greek and Roman character, were unable to throw off the assumptions of their supernatural dogmatics, and their Jewish prejudices against heathenism; and neither could the Greeks and Romans rise above the pride of culture which forbade them to place the Syrian barbarians, among whom the new religion had arisen, on an equality with the revered sages of their own people; or to perceive, beneath its strange traditions, a deeper truth, having an affinity with their own philosophical convictions, and worthy of their serious consideration. If the Christian sect was hated by the mass of the heathen population, by the cultured portion it was despised, and centuries elapsed before contempt and hatred gave way to a more just and worthy conception.

To the heathen nations, the Christians were in the first place atheists; for in every age this name has been given to those who did not agree with the prevailing conceptions of the Deity; not only when they denied his existence, but when they sought to instill a more just and worthy idea of God. "Down with the atheists!" this was

the war-cry of the heathen mob against the Christians. It was with this cry, for example, that in A. D. 156 the venerable Bishop Polycarp was received on the race-course at Smyrna. The only gods the people knew anything about, whose temples they frequented, whose statues they worshiped, to whom they offered sacrifices and prayers, were denied by the Christians; they were declared to be the inventions of man's superstition, and sometimes to be evil spirits, devils. Can we wonder that the people who were still devoted to these gods felt the attack upon them to be an attack upon themselves, their most sacred and cherished possessions; that they were the more deeply incensed at it the more seriously they feared by toleration of it to lose the favor of the gods on whom their welfare depended? The reproach of atheism was therefore the most dangerous that could be brought against the Christians. In that "Down with the atheists!" with which the yells of the mob greeted Polycarp at Smyrna, was included the sentence of death, which they at once proceeded to execute by preparing the stake. And the cry was followed in numberless cases by the same results. If any public misfortune, any alarming event occurred, which seemed to indicate the displeasure of the gods—a pestilence, a dearth, a flood, an eclipse, an earthquake—superstition was always ready to make the Christians responsible for it, as enemies of the gods; the exclamation was sure to be heard, "The Christians to the lions!" Both the educated and uneducated have always attributed every other wickedness to the enemies of the gods, and so it was with the Christians. Being atheists, they were also criminals, and all manner of horrible stories were told of them. It was not enough that they were said to worship a god with the head of an ass, which we see represented to this day in a caricature of that period, the well-known mock crucifix in the Kircher Museum at Rome; it was said, also, that in their secret assemblies they practised all sorts of horrors, killed and devoured children, and gave themselves up to frightful excesses. Scarcely any evils were attributed to the Jews in the middle ages by Christian fanatics which had not been before attributed to the Christians by heathen superstition. How ancient this bad opinion of them was we learn from the account given by Tacitus of the persecution under Nero. When more than two-thirds of Rome was burned to ashes in his reign, and report accused the emperor himself of setting fire to it, he tried to find people on whom he could lay the blame, and selected the sect, says Tacitus, "who were universally hated for their shameful deeds, to whom the people gave the name of Christians." These stupid misrepresentations of the Christians, then, were not only circulated, but so generally believed that but a few years after their rise as a community at Rome, and only two years after Paul's arrival there, Nero could venture to throw on them the responsibility of a public calamity. He was out in his reckoning, however; suspicion still attached to him, and the cruel torments which he inflicted on his wretched victims at last aroused the pity of their enemies. But one thing is obvious—Nero could not have punished the Christians as incendiaries if they had not been judged capable of such a crime; and Tacitus expressly says that they were so.

We cannot, however, be much surprised that the credulous and ignorant masses had not more correct ideas. It is far more astonishing that even the great historian to whom we owe this first mention of the Christians in profane history should share their opinions, and he cannot be cleared from this accusation. He not only treats the excesses of which they were said to be guilty as acknowledged facts, but adds this remark: 'The founder of this sect, named Christ, had been executed under Tiberius, by the Procurator Pontius Pilate. The heinous superstition was thereby checked for a time, but the infection soon spread again, not only throughout Judea, where the disease was indigenous, but also in the capital, where all that is disgraceful and reprobate collects and finds favor." And of the accusation against the Christians he says, "They certainly cannot be convicted of causing the fire, but of being enemies of the human race they can." This is the impression made upon the Roman by what he had heard of the religion and conduct of the Christians. Of atheism, of which the enemies of the popular divinities had been certainly by that time accused, he makes no mention. In the eyes of Tacitus the chief error in the new religion is not disbelief, but superstition. But in his general estimate of them this does not turn much to the advantage of the Christians; they are "enemies of the human race," and from such any crimes may be expected. And after mentioning the fearful torments and cruel scorn with which Nero treated the Christians, Tacitus closes his narrative with these words: "Guilty as they were, and well as they deserved the severest penalties, they excited pity, because it was considered that they

were sacrificed, not for the common weal, but to the cruel caprice of an individual." He admits that they were not guilty of the crime attributed to them, that their being put to death on this ground was judicial murder, and the manner of it an abomination, but he regards them as a sect so depraved and dangerous that their extermination was demanded by the public interest.

The prejudices against the Christians must have taken very deep root, and the contempt with which the educated classes regarded this new form of Oriental superstition must have been very general, before the greatest historian whom Rome has produced could accept, at the beginning of the second century, the notions of the masses and the misdeeds of the Christians as facts, without even taking the trouble to sift into their truth. Under these circumstances, the real facts could not be ascertained about the crimes of which the Christians were accused, and to which even a Tacitus gave credit; nor could the cause of the Christians, which went against them under Nero, be fairly judged, until it should be tried again under a better government and by more just judges. This happened even during the lifetime of Tacitus, and but a few years after he wrote of them as above. The greatest of the Cæsars, Trajan, amid the multitude of affairs to be regulated in his vast empire, found it necessary to interest himself with the Christians and their relation to the state; and the younger Pliny, one of the noblest and most cultivated men of that day, was commissioned to investigate the accusations against them. In the west of Asia Minor, and especially in Bithynia, the province over which Pliny ruled, the Christian religion had found so much favor that in many places, in the cities and even in the country, the temples of the gods were deserted, the festivals were not celebrated, the flesh of the sacrifices scarcely found purchasers. The embitterment of the heathen at this success of their enemies led to complaints. At first individuals, and soon increasing numbers, were informed against to Pliny, as adherents of the Christian sect, a pretext for which was afforded by a recent prohibition of all societies not recognized by the state. Pliny was perplexed; there were then no legal enactments against the Christians, and no method of procedure had been established in practice; at any rate, Pliny, as he himself wrote to Trajan, had never been present at a trial of Christians. Such trials, after the great persecution under Nero, had taken place but rarely under Domitian, and since his assassination there had been none. But, like a true Roman, he looked at the subject from a simple, straightforward, political point of view. Let Christianity be what it might, as soon as it asserted its peculiarities in opposition to the religion of the state and the acts of worship connected with political life, it became dangerous to the state. On this principle Pliny acted. The persons informed against as Christians were summoned to appear, and were asked whether they were such or not. If they confessed it, they were required under pain of death to renounce their faith; if they refused, they were executed, or if, like Paul, they were Roman citizens, they were sent to Rome to be tried. "For I had no doubt," says Pliny, "that their obstinacy and unyielding contumacy demanded punishment, whatever the religion might be that they professed." He who denied that he was a Christian or recanted, after he had shown his reverence for the statues of the gods and of the emperor and cursed Christ, was released. It was certainly a very summary proceeding. The governor, however, took the opportunity of obtaining more precise information as to the religion and lives of the Christians, partly from those who denied Christianity, and partly from two Christian deaconesses whom he subjected to this painful examination. But none of them had anything to tell him of the crimes and horrors of which report accused them; they told him of their religious assemblies, their love-feasts, their adoration of Christ, their moral principles. Pliny wrote that he had discovered nothing in the confessions of the tortured deaconesses but a foolish and boundless superstition. But, widely as it had spread, he hoped to uproot it by severity against those who persisted in it, and showing favor to those who renounced it. This report of Pliny to Trajan undoubtedly shows more knowledge and a more correct view of Christianity than what is said by Tacitus. He gave credit to the slanderous reports of the vices of the Christians, while Pliny does not; he has convinced himself that they are not necessarily connected with Christianity. This accusation is thenceforth confined to the lower classes; it is no longer repeated by contemporary authors. But Christianity is still held to be a strange and absurd superstition, and tolerant as imperial Rome was, in general, of superstition of every kind, in this case toleration was limited by the peculiarities of the Christian religion. All other religious usages were compatible with the established public worship; the Christian religion

could not fail to be opposed to it—the Christians were enemies of the gods, atheists. Pliny does not use the term, but it is really this characteristic which makes him regard them as enemies of the state; they refused to offer sacrifices to the gods and the emperor, and such defiance must be put down. Trajan himself formed the same opinion. In his reply to Pliny's report he approves his conduct, and adds that they are not to be officially proceeded against, but, if they are denounced and refuse to recant their Christianity by worship of the national gods and the emperor, they are to be punished. He evidently considered it to be a comparatively harmless superstition, a delusion which might be tolerated so long as it could be ignored, but which must not be indulged, in consequence of its open resistance to the religion and laws of the state, nor left unpunished when brought before the courts and obstinately persisted in.

Trajan's mandate to Pliny was for a hundred and fifty years the standard by which the relations of the Roman state toward Christianity were regulated, and the views which dictated it remained for a long period unaltered. While among the people the old hatred of the atheists survived, and the old calumnies retained their hold, the new religion was regarded by the educated as one of the many fruits of superstition which inundated the Roman Empire from the East; and whether it was regarded with lenience or severity, as perilous or absurd, its followers as deceivers or deceived, in one thing all were agreed, that it could not be permitted to break the laws against making proselytes and against unauthorized societies. The contumacy which the Christians showed in refusing to join in the public worship of the gods must be put an end to, especially in cases in which, according to the prevailing ideas, the established customs were inseparable from the fulfillment of duties toward the state and its rulers. The three successors of Trajan, and the excellent Marcus Aurelius Antoninus, two generations later, formed the same opinion of the Christians. This emperor was one of the most benign, philanthropic, and conscientious rulers who ever adorned a throne. He was, moreover, a zealous adherent of the Stoic philosophy, which in its morals, and even in its theology, was so closely allied to Christianity. And yet in his reign the Christians were subjected to persecutions more severe than even under Nero. He felt compelled, as Roman emperor, to protect the religion of the state from its pronounced enemies; and, as one of a school which was content to place philosophical ideas and religious myths on an equality, and made terms with the popular religion by the most extravagant allegorization of it, he had no comprehension of the scruples of conscience which made all participation in heathen worship appear to a Christian as an unpardonable sin. In the positive Christian doctrines, which could not, like poetic myths, be evaporated into mere symbols of philosophic dogmas, a Marcus Aurelius could not possibly see anything more than Pliny saw—a "foolish and boundless superstition;" nor, in the steadfastness with which the Christians adhered to them, anything but a stupid obstinacy, originating in defiance and bigotry, and perhaps in a desire to excite attention. And this is just what he says in the only passage in his "Monologues" in which he mentions the Christians (xi., 3): he observes that a man should be ready to die at any time, but with dignity, without boasting; from reasonable conviction, "not out of mere defiance, like the Christians." So little did the devoted heroism of the Christian martyrs overcome the prejudices of the Roman. Marcus Aurelius doubtless pitied the Christians who were put to death by his orders, since he so often tells us that pity is the only sentiment that befits the wise man in view of the folly and perversity of men; but he judged that, for the sake of the common weal and public order, he could not restrain the arm of justice, and, in truth, he had no idea that it was not to justice they were sacrificed, but to political laws and interests which were incompatible with the natural law of liberty of conscience.

Since even a Marcus Aurelius was not able to form an unbiased opinion of Christianity, this will not be expected from one so entirely wanting in religious interests, and therefore in appreciation of religious life and motives, as his contemporary, the satirist Lucian. A man of the world, half skeptic, half Epicurean, could not possibly regard Christianity as anything but one of the follies and fancies of which the age was so prolific. He only mentions it in connection with them. In his book on the cynic, Peregrinus, who had publicly burned himself at the Olympic games in A. D. 165, he relates that this eccentric man had in his younger days belonged to the sect of the Christians in Palestine, had gained a high standing among them, had been imprisoned for his faith, but was afterward set at liberty; and he takes occasion to give his opinions of the Christians. He describes them with a sort of contemptuous pity, as poor simple folk who had been persuaded by the founders of their

sect that they would live forever, and that if they would only deny the Hellenic gods, and worship instead that crucified Sophist and live according to his laws, they were all brethren. He was well aware of the courage with which the Christians died, the joy with which they made any sacrifice for their faith. But this heroism and self-sacrifice had no value in his eyes, being based on notions so fanatical. Their superstition, he says, makes the Christians the prey of every impostor who knows how to work upon it; and while he sees no serious danger in it to the existing order of things, he is equally destitute of any vision of the historical importance and intrinsic value of the new faith. He speaks of it in the superficial tone of a man who is too well convinced of its unimportance to think it worth while to inform himself further about it.

Lucian's friend, the Platonist, Celsus, regarded Christianity in a far more serious light. His knowledge of it is also far more profound. In "The True Word," which he addressed to the Christians between A. D. 178 and 180, he shows an acquaintance with their doctrines and documents in which he is quite alone among the opponents of Christianity till we come to Porphyry. Still, his verdict is not less severe than that of his predecessors. Even though he does not deny that there is some truth in the Jewish-Christian doctrines, this gives Christianity but little advantage in his eyes. As the Jewish and Christian Alexandrians made the heathen sages the disciples of Jewish revelation, the Greek philosopher made the Jews and Christians plagiarists of the wisdom of the Greeks. The good that is found among them they have borrowed from the Egyptians, the Hellenes, and from the nations whose gods they despised. But they have not made a good use of this foreign good; they have misunderstood and distorted the doctrines they have appropriated, and mixed them up with superstitious fancies and fictions of all sorts. Celsus believes everything about the ancestors of the Christians, the Jews, which their heathen foes had been saying about them for centuries; he believes all the calumnies about the founder of Christianity and his disciples, which the hatred of their compatriots had circulated in much the same form as we find them in the later Talmudic writings. Jesus was, according to the well-known Jewish fable, not only of humble but disreputable parentage; in Egypt he learned the arts of a magician and conjurer; after his return to his own country he gave himself out for a worker of miracles and for the Son of God long foretold, and invented the Gospel stories of his birth. He succeeded in collecting around him a few followers from among the lowest rabble, with whom he went about the country, not doing anything more than other magicians had done, or achieving more success. Being betrayed by his own friends, he suffered death for his crimes, and his disciples afterward carried on the imposture. They persisted that he was a God and the Son of God, ascribed miracles to him which he had never performed, put prophecies of his death and resurrection into his mouth, and invented the fable of his resurrection after the pattern of heathen myths, but without adducing any credible proof of it. Christianity is, therefore, from the beginning, not only a worthless innovation but a tissue of lies; the "Sophist," as Lucian calls its founder, now becomes a conjurer, whose magic arts the Platonist will not dispute, though he will not admit that he is anything but a good-for-nothing impostor. And, according to Celsus, the character of the Christian religion accords with its origin. So far as it deviates from what had long before been acknowledged as truth, it is nothing but a compound of superstition and imposture. In order that they may worship the highest God alone, the Jews and Christians refuse all reverence to the other divinities—as if it behooved the highest God to interfere immediately and personally in the material world; as if he had not his servants and instruments by whom he rules the world and in whom he will be honored—those divinities whose glory we admire, those demons whose invisible rule is continually about us, whose favor we have good reason to secure by prayers and sacrifices. And while the Christians refuse the honors due to the greatest of created beings, while they will not admit that Hercules and Æsculapius have been deified, they themselves adore as a God a conjurer who died a shameful death. They assert that it was he whose coming was foretold by Jewish prophets, although his teachings are opposed to the Jewish laws. They call him a son of God, forgetting that they thereby ascribe to the God whose son he was things unworthy of the Deity, just as much as the Hellenic myths. They make God come down to men, ill as it comports with his unchangeableness and perfection. How absurd, again, are their anthropomorphic representations of the Deity; their stories of the creation, the fall, the flood, and the patriarchs; their doctrine of the devil who slays the Son of God, and of Antichrist whom he has to fear as a rival; their

expectation of the return of Christ, the destruction of the world by fire, and the resurrection of the body—a notion which can only be entertained by sensual people! What an arrogant notion of the Christians that the world is created for them only, and that at the end of the world they alone will continue to live in new bodies, while everybody else will be burned in the fire! Such a religion is truly only fit for the ignorant, to whom the Christians for the most part are confined; whoever expects to find credence for such things must look for it among artisans and slaves, women and children, sinful and wicked people, and must exclude all the learned and educated from his community.

But perverse as all this may be, it might be more easily tolerated if the Christians were only following the faith of their forefathers, if they had the excuse of its being their national religion. As it is impossible that all the various nations should worship the Deity in the same way, it is best that every one should worship in the way to which he has been accustomed, and which is acceptable to the tutelar genii of his country. This is the case with the Jews, absurd as the national pride is with which they look down upon all other religions and think their own the only true one. But the Christians have not even this excuse. Originally apostates from Judaism, they are now a medley of renegades from other nations, and are split up into innumerable parties among themselves. And with this the reproach is connected with which Celsus closes his controversy with the Christians—their indifference to the Roman state and its welfare. They will not have anything to do with public worship, and neither do they concern themselves with the public interest. The enmity to the human race with which Tacitus reproaches them meets us again here under the more definite form of want of patriotism.

This polemical treatise of Celsus clearly shows why the better-educated classes among his Greek and Roman contemporaries would, as a rule, have nothing to do with the Christian religion, even when they were somewhat better acquainted with it. They could not take to it because it originated in a sphere, and presupposed a way of thinking, entirely different from their own. Christianity was a religion for the weary and heavy-laden: to him who was ill-treated and set at naught in this world compensation was promised in another; to him who was oppressed by a feeling of moral weakness and guilt it offered to restore peace of mind by the gospel of reconciliation, to raise him into a liberty and joy in moral aspiration hitherto unknown. But those things which had been the delight of the Greek and the pride of the Roman, it counted as the glories of this world, on the ruins of which the kingdom of God was to be established. The more deeply a man was grounded in the culture of the classic nations, the more uncongenial must these views have been to him; the more he valued his culture, the less was he disposed to exchange it for the faith and worship of the barbarians of Palestine. While on the other hand the fewer of these good things had fallen to a man's lot, and the more he belonged to the pariahs of ancient and aristocratic civilization, the more strongly must he have been attracted to a faith which made him at once a member on equal terms with the rest, who in part shared with him the highest good at once in their moral and religious life, and in part held out a sure hope of it in future. Such a one would easily get over those points in the new teaching which were repugnant to the educated. Large as might be the demands made by the Jewish-Christian supernaturalism on the faith of its votaries, in comparison with the mythology of the popular religion, Christian dogmatics bore so rational a stamp, and the change from polytheism to monotheism was in itself so great an advance, that the most dogmatic Christian, the man most credulous of miracles, could at once look down, as a person of superior enlightenment, upon heathen superstitions. He, on the contrary, who had been led by philosophy to renounce this superstition, did not require Christianity to aid him in doing so, and it could not, therefore, gain him over in that way; while all the doctrines which owed their origin to Jewish revelation as such, or were a sequel to it, would inevitably be repugnant to a disciple of Plato or Aristotle, of Epicurus or Zeno, and would only excite ridicule or be subjected to serious refutation. If we consider further the undisguised aversion and hostility of the Christians to the heathen government, and how they withdrew as far as possible from all coöperation with it, it becomes the more intelligible that it was just the more educated portion of the population, the men of political insight, who perceived a danger in Christianity to which the lower classes, minors in a political sense, were partly indifferent and partly blind, and that far-seeing governments, imbued with the political instincts of Rome, should try to check the spread of a religion which must sap the vital forces of the existing order of things.

For Christianity and humanity it was well that these political sentiments did not constantly assert themselves on the throne of the Cæsars. Although it was a great exaggeration to say of the Christians, as Celsus did, that only one and another of them were still wandering about, and that they were in constant danger of prosecution, the rigid measures of Marcus Aurelius against them seem for the time to have met with considerable success. But the renewed attacks of the Marcomans, which, after A. D. 178, demanded all the forces of the empire, must have diverted attention from the Christians, and after the emperor had died in camp at Vienna in A. D. 180, the Christian Church under his successors enjoyed seventy years of rest, which was not disturbed till the middle of the third century by the severe persecution for a few years under Decius and Valerian. The followers of Christ increased so greatly during this period, their mode of life and worship emerged so completely from its previous obscurity, that, in spite of the laws against unauthorized religions, they had become a power which had to be taken account of, or at any rate to be recognized as a fact. The attitude assumed by the public opinion of the Greco-Roman world toward Christianity was inevitably influenced by it. We hear no more of the secret excesses of the Christians after they became more generally known. Hatred of the enemies of the gods became appeased in time, as people had become more accustomed to see Oriental divinities filling a large place beside the ancient gods of Greece and Rome, not only in the religion of individuals, but even in public worship. The aversion of the heathen to Christianity of course continued; jealousy could but be fostered by its successes. But the professors of a religion who formed so large a portion of the population of the empire could no longer be regarded as "enemies of the human race;" and even political distrust gradually disappeared to so large an extent that toward the end of the third century many Christians served in the army, were intrusted with positions of command, important political offices, and places at court.

Under these circumstances, the attacks upon Christianity took a different form. After the middle of the third century the last learned champion of polytheism arose in the neo-Platonic philosophy. But decidedly as it was opposed to Christian doctrine, up to the sixth century, and long after it had gained its outward victories, the neo-Platonists did not venture to deny that there was some truth in these doctrines. The Christian religion had gained so much by its successes and its obvious moral effect, that it could no longer be regarded simply as an imposture or a product of superstition by serious and truth-loving opponents, such as the neo-Platonists mostly were. They even recognized in it a kernel of truth, round which, doubtless, much error and imposture had grown. The founder of Christianity, said these neo-Platonists, was a good and wise man, but his disciples had distorted his doctrine. It was they who first gave out that Christ was a God, and introduced the worship of him as opposed to the popular deities. He himself had worshiped these gods, and with their aid, by means of magic arts, had worked the miracles, the reality of which the philosophers did not dispute; but he did not, therefore, claim to be more than a man, as other sages were on whom the gods had conferred similar powers.

From this point of view, Philostratus, in his "Life of Apollonius of Tyana," about A. D. 230, had, without naming Christ, compared the Gospel representation of him with the neo-Pythagorean ideal of an Hellenic philosopher and prophet; and his disciple, the Emperor Alexander Severus, placed a statue of the founder of Christianity side by side with Orpheus and Abraham, Pythagoras and Apollonius, in his private chapel. It was on similar assumptions that, half a century later, the neo-Platonist Porphyry proceeded in that famous polemical treatise against the Christians, which their hatred caused them so effectually to destroy, that only isolated indications of its contents have come down to us. We learn from these fragments that Porphyry, a learned man, skilled in logic and philosophy, chose just such points for his attack as have, in more recent times, been selected by the opponents of supernatural religion. He asked, with a Reimarus, why had not Christ appeared before, if salvation depended upon him? He thought it incomprehensible that the Christians should reject sacrifice, when God himself had enjoined it on the Jews. In the oft-discussed contest between Peter and Paul at Antioch, he saw a proof that a faith, over which its most enlightened advocates disputed, must be based upon a fiction. He accused even Jesus of dissimulation, because he said he was not going to the feast in Jerusalem, and afterward went.[1] He stumbled at many of the narratives in the Old Testament, and, rightly enough, would not permit the Jews to get over them by allegoric interpretations. With keen eye he detected in the prophecies of the Book of Daniel a

[1] John vii. 8, 14.

forgery of the time of the Maccabees, and gave reasons for it which have lost nothing of their force to this day. He doubtless raised many objections that Christian theologians of the present day would not be able to refute. But there is no tradition that he passed a verdict on Christianity, as a whole, so reproachful and adverse as Celsus did in his day; and, taking into account the attitude generally assumed toward it by the neo-Platonist school, it is not probable that he only regarded the religion of the Greeks as a legal mode of worship, and the Christian as a revolt against that divine ordinance that every nation should worship the gods according to its own traditions.

This is not maintained even by Hierocles, who was of the same school, although a chief share is ascribed to him in the last attempt made by the Roman state to suppress Christianity by force for many years, by the severe persecution under Diocletian, after A. D. 303. In a treatise against the Christians, this neo-Platonist compared the founder of Christianity with the fabulous picture of the neo-Platonist saint, Apollonius of Tyana, as it had been drawn by Philostratus. He tried to show that the Christians need not take their Jesus for a God on account of the few miracles he had performed, and that the heathen judged far more rightly of Apollonius, Pythagoras, and others, far greater workers of miracles than Christ, in regarding them as men beloved by the gods. But he branded the Apostles as impostors, because they had adorned the deeds of their Master with silly stories, while those of Apollonius were handed down by credible witnesses. Even this enemy of Christ does not dispute his greatness as a man, nor even his prophetic character; it is only his divinity that he assails.

It is not until the second half of the fourth century that we find heathen polemics recurring to the tone against Christianity with which they had begun. It had, in the mean time, been made the religion of the state in the Roman Empire by Constantine, and its adherents before long began to suppress the worship of the ancient gods with the same violence which had been employed to put down Christianity. If heathen governments had commanded the Christians, under pain of death, to sacrifice to the gods, these sacrifices were now forbidden by the same penalties; if the heathen mob had raged against the Christians, the Christian rabble were now set on those who would not part with their ancient deities; if it had formerly been necessary to renounce Christianity to be promoted at court and in the army, it was now necessary to adopt it for the same reasons. But Christianity had possessed vitality enough to resist all the allurements and terrors of political power; heathenism, on the contrary, proved so rotten under their altered relations, that, fifty years after Constantine's first edict of toleration, its adherents were in the minority, their ranks thinned more and more, and they were soon only to be found among the uneducated populace in the country, among the upper classes of Rome and Alexandria, and the learned men and philosophers who could not separate the worship of the ancient divinities from classic culture.

It was only natural that this triumph of a foe whom they had never ceased to hate and despise, that the severity with which the triumph was turned to account, that the repulsive spectacle of a nominal Christianity, spiritual ambition, and fierce controversy, which the new imperial Church at once offered, should deeply embitter the subject party. Under Julian's short reign (A. D. 361–363), there was a prospect of once more subjecting the foe. But the restoration of heathenism, projected by this emperor with all the fervor of a neophyte but in utter misconception of the age, could but have failed, even if his speedy death had not put an end to it. Julian had become acquainted with Christianity among his predecessors and relations under its worst form. He had personally suffered from their jealous despotism. Brought up a Christian, he had been obliged to profess this religion when he had already adopted the neo-Platonist philosophy. It was a cherished project with him to restore the worship of the ancient deities when he ascended the throne. But he did not wish to effect it by force; this was forbidden by his principles, his noble sentiments, his respect for justice, and, finally, he could not conceal from himself that the forces at his command were not equal to the task. The severest measure which he took against the Christians was to forbid them to receive public instruction in ancient literature. But this ruler, who prided himself on his philosophy and learning, and was fond of hearing himself speak, could not refrain from writing against them. In his seven books against the Christians, which we know from Cyril's reply, and in his letters, all the ill-humor and contempt which had been accumulating in his mind for years find expression; and this was increased by the pertinacity with which the Christians resisted his measures for converting them. The "Galileans," as he contemptuously calls them in his edicts, are

to him, as to Celsus, people who have departed from the faith of their fathers, in order to construct a new religion out of the worst elements of Judaism and heathenism. They would have nothing to do with the eternal gods, whose laws encompass them, in order that they might worship a dead Jew instead, and, with him, the tombs and bones of other dead men, with which, even in those days, there was fetichism enough. Neither will they listen to Nature and her laws; they appeal to the will of God rather than to any other authority, as if it could ever be opposed to the laws of Nature. Nor will they understand that it is impossible for all nations to have the same religion, and that it is just because they are assigned to different divinities that nations differ so much in their character and gifts. But they have no national worship themselves; they follow the teaching of those deceitful sectarians, the Apostles, and have not even left this alone. How little this teaching is good for is obvious enough; for everything great and beautiful in the world, all noble deeds and all eminent men, have, as Julian believes, sprung out of heathendom. Christianity is a religion of barbarism, and it can only produce barbarians, men of servile minds.

Thus do heathen polemics against Christianity finally return to the same point of view from which they set out. But these polemics had not hindered its advance, and it was a still more vain hope that they could wrest the victory out of its hands. When Cyril wrote his ten books against Julian, the last hope of heathenism in the Roman Empire had sunk into the grave with him. Even the written attacks against the Christians gradually diminished, although many particular doctrines were for a long time discussed between Christian and heathen philosophers.

It was not till recent centuries that these polemics have been revived. Modern opponents of Christianity have repeated many of the reproaches with which Celsus and Porphyry once assailed it, little as they could adopt their point of view as a whole. In many of these reproaches, some who are far from being in principle hostile to Christianity have perceived some truth, and have endeavored to reconstruct it so as to shield it from them. These parallels, however, cannot be pursued further here. Our purpose has been to indicate how the contest of heathenism with Christianity, and the varying attitudes of the one to the other, are reflected in Greek and Roman literature, in order to bring before the view of our readers this aspect of the peculiarities and motive of that world-wide movement out of which modern society and its civilization have arisen, with the triumph of the Christian religion.—*Contemporary Review.*

MENTAL PHYSIOLOGY.[1]

WE reported in our impression of yesterday an interesting lecture by Dr. Carpenter on "Mental Automatism." The glimpse our readers will thus have got of the question may have probably roused a desire to know more of it; and we, therefore, make no apology for noticing, somewhat tardily, Dr. Carpenter's "Principles of Mental Physiology," in which the whole subject is treated most ably and thoroughly.

The study of the natural history of the human mind, if it could be at all adequately pursued, or carried to the attainment of any definite conclusions, would so obviously transcend every other in importance that it is unnecessary to dwell upon the advantages which might be expected to follow from its cultivation. During many years, unfortunately, this study was only attempted by methods which were necessarily sterile of results—that is to say, by the introspective self-examination of persons more or less gifted, in whom all mental processes had attained the highest degree of complexity. The dawn of a more hopeful future may be said to have commenced in this country nearly thirty years ago, at the time when Mr. Justice Grove's discovery of the correlation of the physical forces led almost inevitably to the suggestion that the vital force, the power underlying the actions of living organisms, must itself be a kindred member of the group formed by motion, light, heat, magnetism, electricity, and chemical affinity; and, when the

[1] "Principles of Mental Physiology, with their Applications to the Training and Discipline of the Mind, and the Study of its Morbid Conditions." By William B. Carpenter, M. D., LL. D., F. R. S., F. L. S., F. G. S., Registrar of the University of London, etc. 8vo, pp. 737. Revised edition, 1877. New York: D. Appleton & Co.

then recent investigations of Sir Charles Bell, Marshall Hall, and others, had begun to elucidate the nature of sensation and motion as functions dependent upon the properties and the integrity of the nervous system. It had long been evident that the operations of the mind, whatever might be their original source in a higher or spiritual nature, were recognizable as operations of the brain, which was, at any rate, the immediate instrument of their performance; and it was soon perceived that all the modes of activity of the nervous system, from the lowest to the highest, were united in one continuous series, which could only be successfully investigated by beginning with the simplest forms of their display, and by then tracing upward to the summit the separate strands of an ever-increasing complexity of structure, and the separate rudiments of an ever-increasing variety of use. In this work Dr. Carpenter was himself the pioneer, and it was one of his first achievements, by the application of comparative anatomy, or the study of the nervous endowments of the lower animals, to crumble the whole fabric of phrenology into dust. He showed, in the *British and Foreign Medical Review* for 1846, that the first rudiments of brain found in ascending the animal scale were rudiments of the anterior lobes, that the middle and the posterior lobes were gradually added, that the posterior lobes reached their full development in man alone; and hence that the hypothesis which seated the intellectual qualities in the anterior lobes, the moral qualities in the middle lobes, and the animal propensities in the posterior lobes, was in direct contradiction to the unbroken order of Nature. In the same article, the publication of which formed an epoch in the history of nervous physiology, he established cardinal principles, which he has since done much to elucidate and to develop in the successive editions of his great work on physiology, and which, in the present treatise, he has given to the world in the most finished form that, in the present state of knowledge, they are capable of receiving. In order to render them even partially intelligible it is necessary to endeavor to sketch some outline of the essential conditions under which nervous functions are performed. In doing so, we are constrained by the exigencies of space to limit ourselves to the most simple statement, and must refer those who desire illustration and elucidation to the pages of the book which lies before us.

The fundamental conception of a nervous system is of a central body or ganglion, which is itself a seat of activity, and which receives an "afferent" fibre from some remote part of the body, and sends forth an "efferent" fibre to the same or to some other part. The afferent fibre conveys intelligence of some change occurring in the external part in which it terminates; the efferent fibre conveys from the centre an impulse consequent upon that intelligence. All this, in its essential nature, is independent of sensation or of the knowledge of the animal, and is said, in physiological language, to be automatic. In the human body there are ganglia in the lower part of the spinal cord, which receive afferent fibres from the sole of the foot, and send out efferent fibres to muscles which move the leg. The actions hence arising are usually the subjects of consciousness, but this is only because the seat or organ of consciousness is attending to them. When there is disease limited to the middle part of the spinal cord, but cutting off this part from communication with the brain, and when the legs of the patient are concealed from his sight by the interposition of a screen, the essential independence and the automatic character of the spinal movements may be readily demonstrated. If the sole of the foot is then tickled by a feather, the tickling will produce an impression upon the extremity of the afferent nerve. This impression is conducted to the central ganglion, whence an impulse is conveyed along the efferent nerve to muscles of the leg, and the foot is drawn up or moved away. Very violent action may often be obtained in this manner, the patient feeling neither the tickling nor the movement, and remaining unconscious of both. Such movements, which are neither voluntary nor attended by sensation, but are produced by the automatic response of the simplest form of nerve-mechanism to the stimulus of an "impression," are called "reflex." In some of the lower forms of animal life the fibres and ganglia necessary for reflex movements are detached from one another, and distributed irregularly about the body; but in the class of insects named *Articulata*, of which the common centipede may be taken as a good example, the ganglia are united into an axial chain, which essentially corresponds to the spinal cord of the higher animals and of man. The purely reflex character of many of the apparently "purposive" or voluntary actions of the *Articulata* was first demonstrated by Dr. Carpenter in his "Inaugural Dissertation" at Edinburgh for the degree of M. D., which was published in 1839. His views were at that time strongly opposed by Mr. Newport, who became a convert to them four years

later, and who announced to the Royal Society his conversion in a paper on "*Scolopendra*," which was printed in the "Philosophical Transactions." Notwithstanding the proof of priority thus afforded, and notwithstanding that Prof. Owen, before Mr. Newport's paper had been read, had announced his own acceptance of Dr. Carpenter's doctrine, and had given Dr. Carpenter full credit for having originated it, some Continental writers have assigned the honor of the discovery to Newport. The evidence is so clear that the point is not worth discussing, but it is mentioned in order to show for how long a period Dr. Carpenter has occupied a prominent place among the philosphers who have made a special study of the functions of the nervous system. Returning from this digression, it is to be observed that the *Articulata* possess not only a chain of centres of reflex action, usually one for each segment of the body, with afferent and efferent nerves which are mainly subservient to the movements of the legs, but that they also possess organs of sense, notably large and well-developed eyes, from which afferent nerves proceed to special ganglia. These differ from the ganglia of the cord in this, that the central change produced in them by an impression made upon their afferent nerves is attended by sensation. The efferent nerves from the optic ganglia, or some of them at least, pass down the cord to its own simple reflex, or "motor" ganglia, and exert either a "motor" or a controlling influence upon them; but the effects which are thus produced, although attended by sensation, may be just as purely "reflex" or automatic, as entirely dissociated from any idea of the purposes which they fulfill, as those which are produced directly by the motor ganglia themselves. When a centipede is running along the ground its progression is reflex only. The successive contacts of its feet with the surface send impressions along the afferent nerves to the motor ganglion of each segment, and these impressions produce changes in the ganglia which cause motor impulses to be sent along the efferent nerves to call the muscles of the legs into action. If a visible obstacle is placed in the insect's path, as soon as this is seen—that is to say, as soon as the impression made upon the afferent nerves of the eyes has been communicated to the optic ganglia—the resulting change is conveyed by their efferent nerves all along the axial cord, or chain of motor ganglia, and first arrests, and then modifies, the motion of the legs The insect will first stop, as if to reconnoitre the obstacle, and will then turn away, as if to avoid it. If the axial cord is completely cut through in two places, the movements of progression will be unaffected, but the power of the sense of sight to arrest motion will only extend as far as the first place of division. When the obstacle is seen, the legs of the anterior third of the body will stop moving, but those of the posterior two-thirds will continue their movement, and will push the anterior third along. If the motor ganglia between the two places of division are destroyed, the legs of the middle segments will be paralyzed, and will cease moving; but those of the anterior and posterior segments will carry the middle ones along. When an obstacle is seen, the legs attached to the anterior segments will stop; those attached to the posterior segments will continue their progression; and the middle segment, the legs of which are paralyzed, will be doubled up between the other two. In the higher animals and in man the spinal cord is surmounted by several pairs of sensory ganglia, which collectively form what is called the sensorium, and which are subservient not only to the "five" senses of sight, smell, hearing, taste, and touch, but also, in all probability, to every variety of consciousness, even to the consciousness of the intellectual operations. It is believed that the brain thinks, as the eye sees, without the production of consciousness until the thought-change has been conveyed to the sensorium.

Pausing for a moment upon the two great nerve-functions which have been mentioned, reflex motion and sensation, it is found that they produce or govern a very considerable proportion of the vital actions of man. Perhaps the best example of a purely reflex action is the sucking of a newly-born infant, which is excited by the contact of any soft substance with its lips; and the ordinary movements of the chest in breathing are of the same character. The presence of venous blood in the lungs produces an impression upon afferent nerves which proceed to the respiratory ganglionic centre, and the resulting change in that centre directs a wave of motor impulse along the efferent nerves which proceed to the muscles by which the chest is moved. But in man, and probably also in the higher animals, the change produced in the motor ganglion is not limited to the motor channel of discharge, but also passes upward to the sensorium and excites sensation, so that the original impression is felt. This is more especially true when the impression itself is of unusual intensity. For example, we are ordinarily unconscious of the impression which

originates the breathing moment; but if the breathing is arrested (even voluntarily) for a few moments the impression is at once acutely felt. It follows that the stimulus conveyed to a motor ganglion by its afferent nerve may either be reflected along the efferent nerve at once, and may exhaust itself in motion, or it may pass on to a sensory ganglion, and may excite sensation. The sensory, like the motor, ganglia send out efferent nerves to muscles, and are essentially motor ganglia themselves, with the difference already mentioned, that the changes produced in them are attended by sensation. Many of the actions which they excite are as purely reflex, or automatic, as those excited by the motor ganglia themselves. The sudden closing of the eyelids when any substance is seen to approach the eye, the yawning which is produced by the sight of yawning in others, the start which follows an unexpected sound, are familiar examples which might be multiplied a thousand-fold. Such actions, which are automatic and involuntary, but which differ from those formerly described as "reflex" in being accomplished by the agency of a sensory ganglion, are called "sensori-motor," and in most of them the sensation appears to fulfill no other purpose than that of being conducive, under ordinary circumstances, to the pleasure of the animal. The two groups together, the reflex and the sensori-motor actions, contribute largely to form the sum of what is properly called instinct—they are impulses "prior to experience and independent of instruction." Many of them present a character of adaptiveness which is curiously deceptive as regards the intelligence or knowledge of the animals engaged in performing them. These animals are alike unconscious of a purpose, and unable to act otherwise than they do, but the original or true instincts, probably in every case, are directed to the maintenance of life, to the capture of prey, to escape from anger, or to the perpetuation of the species.

The growth and nutrition of the nervous centres, like that of other organs of the body, are increased by active employment; and hence a good many capacities for action, which are naturally dormant, are capable of being developed by use until they become acquired or secondary instincts; and these, or an increased aptitude for acquiring them, become hereditary in the course of a few generations. The "pointing" of dogs, which is manifestly an instinct modified by training, and which is now often perfectly well done by puppies the first time they are taken out in quest of game, is a familiar example furnished by a lower animal; but the acquired instincts are seen most frequently in mankind, who are more exposed to the necessary training. Any kind of muscular action, such as the fingering of a musical instrument, the working of a treadle, or even the act of writing from dictation or from a copy, may assume a purely sensori-motor character, so that it can be performed automatically and with perfect correctness when the thoughts are far away. Dr. Carpenter relates some very curious illustrations of this.

In the higher mammalia, and in the greatest degree in man, the sensorium is crowned by yet another pair or assemblage of ganglia, constituting the cerebrum, which has for its office the formation of ideas. An impression made upon the sensorium, whether by the passing upward of a message from a motor ganglion or directly through an organ of sense, may either discharge itself in sensori-motor action or it may pass on to the cerebrum and lead to the formation of an idea about the impression. The idea is not itself an object of consciousness; but it becomes so as soon as it is carried back to the sensorium by the efferent nerves of the cerebrum. It is then recognized; and at this stage of its history it may go out in purely automatic action, which is called ideo-motor. Thus the idea of a disgusting object may occasion the muscular effort of sickness, just as perfectly as the sight or smell of the object itself. An idea which excites anger may lead to a sudden blow; or one which excites fear may lead to sudden efforts to secure safety. An officer was once breakfasting alone, in an Indian jungle, in a tent supported by a tall central pole of smooth and slippery bamboo. A tiger walked into the tent. The officer climbed to the top of the pole, and remained there until his uninvited visitor had departed. The stimulus to this extraordinary feat was not the sensation, not the sight of the tiger, but the idea of the danger arising from its proximity; and all panic-stricken flight is in like manner ideo-motor.

There is great reason to believe that the nerve-changes already mentioned, coupled with emotions—which may be defined as ideas with which feelings of pleasure or pain are associated—and with memory, or the faculty of remembering past ideas as matters of personal experience, are sufficient to explain all the particulars of the conduct of the lower animals. It is probable that the actions of a dog, when they are neither reflex nor sensori-motor, neither original nor acquired instincts, are always ideo-motor, and always the inevitable results of the balance of his past ex-

perience, so that they could be foretold with certainty if this experience were fully known. But in man, over and above all which the lower animals possess, there is also a true volition, rudimentary enough in many instances, but capable of great development in two different directions—first, as an inhibitory power, to restrain either reflex or sensorial or ideo-motor impulses from going out in action—to hold the machine of the body still in spite of them; secondly, as a selecting power, to retain certain ideas before the consciousness to the exclusion of others, to "dwell" upon them by deliberate choice, and thus to derange the balance of mere experience, and to give to the selected ideas an increased weight in determining the conduct. When the merely restraining action of the will is removed, and the idea is suffered to work itself out in action, such action is said to be "voluntary;" but when the will is employed to maintain and continue a selected course, the action is then said to be "volitional."

We have already seen that sensorial impulses, when constantly directed into some definite channel, lead to acquired instincts; and these in time become, if not irresistible, yet nearly as powerful as the instincts which were original. A practised musician was once a learner who had to acquire finger-movements singly, slowly, and laboriously. He arrives in time at a condition in which he is unconscious of what his hands are doing, and in which he simply permits the visual sensations derived from the printed notes, or the ideas lingering in his memory, to run away with his muscles as they will. The change is believed to depend on a distinctly structural change in the nerve-centres, which have "grown to" a certain method of activity; and hence, probably, it is wrought most easily in early life, when the structures of the body have a greater capacity for development than that which they afterward retain. What applies in this way to the sensorial centres applies likewise to the cerebrum; and the power to select from among the ideas which offer themselves to the consciousness, as well as the facility of dwelling upon particular classes of ideas, increases rapidly under the influence of well-directed effort. Dugald Stewart, though he was not guided by the light of modern physiology, was well aware of the difference between volitional and automatic attention. The condition of learning anything, and especially of learning anything which is not of itself attractive to the learner, is one of volitional attention; and this, like most other forms of volitional effort, is both fatiguing and intermittent. Dugald Stewart pointed out, moreover, that what we are conscious of in such circumstances is not our attention to the subject-matter, but only our lapses of attention, and our efforts to bring back the thoughts to points from which they perpetually wander. When the pursuit is inherently attractive, the attention paid to it becomes automatic, the thoughts have no tendency to wander, and no consciousness of effort or of fatigue is experienced. Between these two states there is an intermediate one, in which the direction of the thoughts, at first purely volitional, intermittent, and fatiguing, is rendered daily more and more easy by constantly-recurring habit, and becomes at last a second nature to the individual.

On the basis of the principles which are thus sketched in the barest outline, and by the aid of a variety of illustrations derived from the daily conduct of mankind—illustrations which, when taken singly, are often trivial, but which in most cases so fit into the mosaic of the argument as to complete a pattern of great symmetry and beauty—Dr. Carpenter has built up a natural history of the mental faculties which will fully repay the most careful study that can be bestowed upon it. His account of "Memory," of "Common-Sense," of "Unconscious Cerebration," and of "Reverie and Somnambulism," will be absolute revelations to the great majority of readers; and, when once certain preliminary details have been mastered, the facts and arguments upon which he relies are stated and explained with a freedom from technicalities, and with a pellucid clearness of thought and diction, which leave nothing on either score to be desired. Of equal temporary, although of less abiding interest, are the chapters in which he analyzes the marvels described under the names of "biology" and "spiritualism," chapters which withdraw these marvels wholly from the domain of the supernatural, and arrange them, as far as they may be assumed to be real, under their proper places in a system which takes note of the aberrations and perturbations as well as of the health and normal acts of the nervous apparatus of mankind. We must observe, however, that it will for most persons be wasted labor to turn to these portions of the volume until those which precede and lead up to them have been perused with due attention, since the former contain the keys by which alone the latter can be unlocked. Until the mechanism of the ordinary varieties of mental action is fully understood, it will be generally useless to attempt the comprehension of varieties which are more intricate.

The practical question which underlies Dr. Carpenter's work, and to which this work to some extent furnishes a reply, may, perhaps, be most clearly put by asking how far our knowledge of the organs which are subservient to the mental operations, and of the conditions under which these organs act, will enable us to modify the nature of the operations themselves; how far they will assist us in guiding the moral and intellectual faculties of man, and in making each successive generation wiser and better than those which have preceded it. Until now it must be confessed that education, whether intellectual or moral, has been an empirical art, chiefly practised by persons who have despised and avoided the knowledge of the simplest rudiments of physiology. The late Dr. Arnold stood almost alone, for a long period, in his endeavors systematically to influence moral character by scholastic discipline; and even he, although he displayed a clear perception of some of the means to be used, and of the ends which might be compassed by using them, could have had little or no knowledge, certainly no precise knowledge, of the *modus operandi* of his method. Dr. Carpenter tells us, on the other hand, that the scientific educator should possess a very great degree of control over both the moral feelings and the purely intellectual acts of his pupils; and that education, using the word in the sense given to it by Paley, to express every preparation which is made in our youth for the sequel of our lives, should not only exert a potent sway over the thoughts and acts of those who have been trained by proper means, but that also, besides producing a decent conformity to accepted social standards, it should produce, in every successive generation, a distinct elevation of the race. In each individual it may be admitted that the capacity for improvement is confined within comparatively narrow limits, imposed by the physical condition of the brain-substance; but it may fairly be doubted whether these limits are reached as a general rule; and the readiness of the brain to "grow to" habitual methods of activity, and to transmit its thus acquired capacities to posterity, would sufficiently provide for a progressive increase in the powers of each generation to acquire and to apply knowledge.

Regarded by the light of physiology, we ought to begin to see our way toward a great educational reform. It ought to be within the power of the educator, if the principles now enunciated by physiologists are well founded, to determine, in the first place, the nature of the responses made by the nervous system to external impressions, and, in the next place, the nature of the ideas which should be kept most prominently before the consciousness, and which, therefore, should become the "motives" by which the general course of conduct will be governed.

With regard to the first of these points, it is necessary to revert to the account already given of the difference between sensori-motor and ideo-motor action, and to show that, as it is the natural tendency of an undeveloped nervous system to perform the humbler rather than the higher function, to allow impressions made upon the sensorium to expend themselves in sensori-motor action rather than to pass on through the sensorium and to excite ideas, it should be the constant endeavor of the educator to overcome this tendency, and so to direct and reiterate the impressions made by teaching that ideas should in time become their habitual results. There are probably few teachers who have not heard something about the possibility of "learning by rote" (which is one form of merely sensorial activity in which certain sounds have become associated with the sight of certain written or printed symbols, and are uttered when these symbols are seen or remembered), but there probably is not one in a thousand who understands what "learning by rote" is—how it is accomplished by the nervous centres, how it differs from learning with the intelligence, and how it may be detected and exposed under whatever guise it may be concealed. The great majority of teachers think that they have banished learning by rote when their pupils are able to "explain" their first answer to a question by a second one; the second, in most cases, being as purely sensorial a symbol as the first, and the original sight-symbol, with its two vocal equivalents, being really, as far as "ideation" is concerned, an unknown quantity for which either of two other unknown quantities may be substituted. One of the most familiar illustrations of sensorial action is that which was recorded by the late Mr. Brookfield, in which two children, aged about eleven years, who did their arithmetic and reading tolerably well, who wrote something pretty legible, intelligible, and sensible, about an omnibus and about a steamboat, were called upon to write down the answers of the Church Catechism to two questions. The children had been accustomed to repeat the Catechism during half an hour of each day, in day-school and Sunday-school, for four or five years, and this is what they wrote:

"My duty toads God is to bleed in him to fering and to loaf withold your arts withold my mine withold my sold and with my sernth to whirehp and to give thinks to put my old trast in him to call upon him to onner his old name and his world and to save him truly all the days of my life's end."

"My dooty tords my Nabers to love him as thyself and to do to all men as I wed thou shall do and to me to love onner and suke my farther and mother to onner and to bay the queen and all that are pet in a forty under her to smit myself to all my goones teaches sportial pastures and marsters to oughten mysilf lordly and every to all my betters to hut no body by would nor deed to be trew in jest in all my deelins to beer no malis nor ated in your arts to kep my ands from pecking and steel my turn from evil speak and lawing and slanders not to civet or desar othermans good but to lern labour trewly to get my own leaving and to do my dooty in that state if life and to each it his please God to call men."

It will be observed that these written answers, if recited with sufficient rapidity in the customary school-room patter, really bear a horrible likeness to the sounds of the genuine ones; and there can be little doubt that the writers and their classmates had so recited them for years, to the entire satisfaction of all who were "pet in a forty" over them. Even in Mr. Brookfield's report, from which the examples are taken, there is no evidence of any perception that they represent a nervous action which, as a result of teaching, is wholly wrong in kind, and not only in degree, and which, so far as it is permitted to continue, is not merely an expression of waste of time, but of the growth of habits directly antagonistic to, and incompatible with, those which it should be the chief object of instruction to encourage. Until this is recognized and acted upon, and until teachers have some knowledge of the profound difference between the two kinds of action as modes of mental operation, it is hopeless to expect from schools an amount of cultivation of the intelligence at all commensurate with the magnitude and costliness of the machinery which is employed. Nay, more, as the brain "grows to" its habitual methods of activity, the habits which are to lay the foundation of any real intellectual growth must be established early in life. It is vain to expect the best results as long as it is practically held that the junior classes may be handed over to pupil-teachers or other imperfectly-skilled persons. It should be the special work of the master to guide the minds of the youngest children through the recognition of sensations to the formation of ideas; and, if this foundation were well laid, the subsequent care of the same pupils might be safely left to inferior hands. In schools for the poor this division of labor is especially important; because, as a rule, the children who attend these schools are almost entirely dependent upon them for such culture as they receive. In their homes there is no floating information, there are no *stimuli* to arouse the dormant intelligence.

Supposing that the stimulus of an external impression has been restrained from being reflected as motor-force through the sensorium, that it has been carried upward to the cerebrum, and has there given rise to the formation of an "idea," this idea may either go out at once in instinctive or purely automatic action, or it may be detained by the volition and considered in various aspects before action is determined upon. The former course of events is that which is natural, the latter is a result of education. For example, a child sees some delicacy within its reach. The visual sensation excites ideas of the pleasures which would be afforded by possessing and consuming the delicacy. The untaught child at once endeavors to seize the tempting object. The educated child, on the contrary, detains its idea, thinks before acting, remembers that it has been forbidden to take what is not offered, and refrains. There are many ideas which have no very powerful tendency to produce action, and which it is easy to restrain. There are others which are in their nature acutely pleasurable, or acutely painful; and these, together with the pleasure or pain which is associated with them, are called emotions, and their tendency to produce instinctive action can only be restrained with difficulty. When the teacher has guided his pupils to the formation of ideas, he should next guide them to a knowledge of the way in which ideas should be employed, and to the rudiments of the art of restraining them.

Apart from certain emergencies in which instinctive and appropriate action upon an idea (which is then very incorrectly called "presence of mind") is immediately necessary for the avoidance of some injury or danger, it may be broadly said that almost the only desirable form of ideo-motor action, the only form of it which should be cultivated by educators, is the conversion of thought into language. A person who has decided upon giving utterance to his thoughts on any given subject should be able to surrender the choice of words and the formation of sentences entirely to automatic action; and, thinking about

his thoughts, should never be recalled from them to think about his words. In this respect, much of the higher education of the world is conducted on an essentially faulty principle, by which the words and phrases of a language are made subjects of reflection. The operation in these cases may be good for the mental faculties, but it is very bad for the language, and it is still worse for the language-using faculty. The shrewd sense of Cobbett enabled him to anticipate the results of physiologists, when he said that children should learn languages as birds learn to chirp and sing—that is, by imitation. The genius of Mr. Prendergast led him to the same conclusion; and the principles laid down in his "Mastery System of learning Languages" are in absolute accordance with all that is known about the proper relations of the nervous centres to the act of speech.

As the power to arrest a sensation from going out in action, the power to detain it and dwell upon it, so as to become acquainted not only with its general character but also with the small peculiarities by which it may be differentiated from others of like kind—as this power lies at the root of the faculty of observation, so the power to prevent an idea from going out in action, the power to detain it and examine it in all its bearings, lies at the root of the faculty of reflection, and affords materials for the operations of the judgment and of the will. The former steps in to decide upon the conduct that shall be pursued, the latter carries the decision into effect. Want of space forbids us to point out how little is intelligently done, in ordinary schools, to cultivate the power of observing—although without this power there cannot only be no accuracy, but even no love of truth; and we can only glance in the slightest way at the bearing of educational methods upon judgment and will. It is comparatively easy to restrain ideas which excite no feeling, but the great work of the educator should be to give a similar control over those which have been mentioned as the emotions. Using the words in their widest sense, conduct must in every case be determined either by emotion or by will. The human agent, when an idea which is associated with pleasure or pain is presented to his consciousness, either acts on the emotional impulse, to secure the pleasure or to avoid the pain, or he considers and decides. Between the typical cases on both sides there will be many in which emotion and volition have a struggle for mastery, a struggle that may terminate in favor of either. But it should be one great aim of education to withdraw conduct from the control of emotion, and to place it securely under the control of will; the word conduct, in this relation, being used to include the direction of the thoughts as well as of the acts. The predominance of an emotion, whether it be good or bad when abstractedly considered, means the predominance of the emotional state over the will; and the volition which is habitually subjugated by a so-called laudable emotion will be subjugated with equal ease by any other when the first is exhausted or superseded. This is a matter of familiar experience in those emotional forms of religion which are continually being displaced by the ascendency of other kinds of passion. Emotion invests certain ideas with an inherent attractiveness which renders it easy to dwell upon them, but which does not on that account render them any the more trustworthy as motives of conduct.

The power to retain ideas before the consciousness, and to examine them in all their bearings, has an equal applicability to the moral and to the intellectual side of man's nature. When exerted with reference to the former, it leads to the growth of a standard of duty in accordance with knowledge, and to the shaping of the life in harmony with this standard. When exerted with reference to the latter, it leads to the possession of mastery over the attention, to the ability, that is, to fix the thoughts upon some predetermined object of pursuit. How these great ends, which are necessary conditions to the attainment of excellence, may be worked for, and compassed, we must leave our readers to learn from Dr. Carpenter himself, saying only that he tells the story in the language of a master of English, with a simplicity and directness before which difficulties and obscurities vanish like ghosts in sunbeams, and with a copiousness and aptness of illustration which are rendered the more valuable by being derived from the most ordinary acts and circumstances, so that the experience of daily life is made to furnish a key to some of the most recondite problems of physiology. It would be difficult to exaggerate the benefit which a full comprehension of the principles thus dealt with would be calculated to confer upon the coming generations of the human race.

Lastly, in a concluding chapter of eloquence and dignity worthy of its subject, Dr. Carpenter grapples boldly with the attitude of Science toward Religion, and with the doubts and difficulties of those who are unable to reconcile a reign of

law with a personal government of the universe. In this chapter, as well as in some others, he will probably fail to satisfy the holders of extreme views on either side, but—though success in the attempt can almost necessarily only be partial—in his book, as in his "Presidential Address" at the Brighton meeting of the British Association, he has done much to reconcile aspects of truth which cannot be in real opposition to each other. We have not hitherto been able to afford him space to speak for himself, but we must cite, as the conclusion of this article, the paragraph which terminates his volume. We can only prefix to it the expression of a hope that this volume may not only be read, but studied, and that it may be studied with especial care by all who are responsible for the education of the young. The paragraph itself is as follows:

"Thus, then, if theologians will once bring themselves to look upon Nature, or the material universe, as the embodiment of the Divine thought, and at the scientific study of Nature as the endeavor to discover and apprehend that thought (to have 'thought the thoughts of God' was the privilege most highly esteemed by Kepler), they will see that it is their duty, instead of holding themselves altogether aloof from the pursuit of Science, or stopping short in the search for scientific truth wherever it points toward a result that seems in discordance with their preformed conceptions, to apply themselves honestly to the study of it, as a revelation of the Mind and Will of the Deity, which is certainly not less authoritative than that which he has made to us through the recorded thoughts of religiously-inspired men, and which is fitted, in many cases, to afford its true interpretation. And they cannot more powerfully attract the scientific student to religion than by taking up his highest and grandest thought and placing it in that religious light which imparts to it a yet greater glory. They will then perceive that although, if God be *outside* the physical universe, those extended ideas of its vastness which modern science opens to us remove him farther and farther from us, yet, if he be embodied *in* it, every such extension enlarges our notion of his being. As Mr. Martineau has nobly said: 'What, indeed, have we found by moving out along all radii into the Infinite? That the whole is woven together in one sublime tissue of intellectual relations, geometric and physical—the realized original, of which all our science is but the partial copy. That Science is the crowning product and supreme expression of human reason. . . . Unless, therefore, it takes more mental faculty to construe a universe than to cause it, to read the Book of Nature than to write it, we must more than ever look upon its sublime face as the living appeal of Thought to Thought.' But the theologian cannot rise to the height of this conception unless he is ready to abandon the worship of every idol that is 'graven by art and man's device'—to accept as a fellow-worker with himself every truth-seeker who uses the understanding given him by 'the inspiration of the Almighty' in tracing out the divine order of the universe, and to admit into Christian communion every one who desires to be accounted a disciple of Christ, and humbly endeavors to follow in the steps of his Divine Master."

—*London Times.*

THE ALKALINE AND BORACIC LAKES OF CALIFORNIA.

By J. ARTHUR PHILLIPS, F.G.S.

IMMEDIATELY east of the range of the Sierra Nevada is an extensive region of alkaline lakes and hot springs, of which very large areas are almost totally barren, the only vegetation consisting of wild-sage, yucca, a few cacti, and scanty tufts of bunch-grass.

This district affords, in its many extensive craters and in its lavas, basalts, and obsidians, the most conclusive evidence of its volcanic origin, while its solfataras and boiling springs may be regarded as the last representatives of active vulcanicity. The region is one of great scientific interest, and, as it may eventually become industrially important, it has been thought that a brief description of the district, as well as of that of the borax-lakes, lying on the western side of the Sierra, might not be without general interest.

The most remarkable of the alkaline lakes of this portion of California are Mono and Owen's Lakes. The former lies in a depression occupying a portion of an elevated plateau of desert land, situated at the eastern base of the Sierra Nevada between the head-waters of Owen's and Walker's Rivers. The distance from the summit of the range to the lake-shore is about six miles, and the difference of elevation is about 6,000 feet. On all sides, excepting toward the Sierra, this

lake is surrounded by a wide belt of desert, the total area of which is from 400 to 500 square miles.

Mono Lake is about fourteen miles long, from east to west, and nine wide, from north to south; but it was formerly much larger than it is at present; this is indicated by numerous terraces, by means of which the lines of its ancient shores may be readily traced.

The water of this lake, which has a high specific gravity, and is alkaline and extensively saline, is not easily thrown into waves, but is generally smooth and glassy. Near its north shore there are springs which have produced extensive deposits of tufa, some of which rise several feet above the surface in forms resembling gigantic fungi.

There are numerous islands in this lake, two of which are of considerable size, the largest being two and a half miles long, from north to south, and the other about half a mile in length, from east to west. These, as well as a group of smaller islets lying to the north, are entirely composed of volcanic materials.

On the northeastern corner of the larger island are extensive hot springs and steam-jets, covering an area of some thirty acres, and extending into the lake. The escape of steam and hot gases from so many hundreds of vents is attended with much noise, and the sides of the orifices of many of the fumaroles are incrusted with a reddish-brown substance, which is probably chloride of iron. In the neighborhood of these springs there is a slight smell of sulphurous acid, but no free sulphur is deposited. Some of them furnish a copious supply of boiling water, large quantities of which enter the lake, and so perceptibly raise its temperature for a considerable distance around. Much gas and steam escape from a fissure caused by the sinking of a portion of the crust, while on the eastern part of the island are two well-defined craters, now filled with water.

Mono Lake is, during the summer, the resort of myriads of gulls and other aquatic birds, which are most numerous during the breeding-season, but the water is believed to be entirely destitute of life, with the exception of a small crustacean, *Artemia fertilis*, nearly related to the so-called brine-shrimp (*Artemia salina*) found in the strong brine of the salt-pans on European coasts, and the *Koo-cha-bee* of the Indians, a whitish larva, occurring in immense quantities, and which is much esteemed by them as an article of food.

Stretching south of the lake is a chain of extinct volcanoes, presenting the form of truncated cones, of which the generally steep sides are covered with ashes and other loose materials. Obsidian and pumice are abundant on the surface of these cones, and also cover the plains at their base.

Owen's Valley is a narrow basin lying south of Mono Lake, and running nearly north and south for a distance of about 140 miles. Its average width may be taken at ten miles. It is bounded along its western edge by the Sierra Nevada, which in this portion of its course presents an almost unbroken wall, of which the highest peak, opposite Owen's Lake, reaches an elevation of 15,000 feet. No pass crosses it at a less height than 11,000 feet, and near the lake-shore the descent from the summit to the valley beneath must have an average inclination of at least 1,000 feet per mile, the distance being from ten to eleven miles, and the difference of level between the highest point of the pass and the valley being from 10,500 to 11,000 feet.

On the eastern side of this valley are the Inyo Mountains, toward its southern end, and the White Mountains farther north. This range is dry and desert-like, and not a single stream of any size flows from it into Owen's Valley, which is exclusively watered by the melting of the snows accumulated during the winter months on the eastern slope of the Sierra. Owen's River rises a short distance from the source of the San Joaquin, and, after flowing for a distance of 120 miles, falls into Owen's Lake in latitude 36° 20′ north, longitude 118° west from Greenwich. This lake, of which the water is exceedingly saline and strongly alkaline, is twenty miles long and eight wide. It has no visible outlet, and its shores are often thickly coated with a snow-like alkaline incrustation.

No fish inhabits its waters, but *Koo-cha-bee* is abundant, and at certain seasons is carried in by the waves and deposited on the shores in layers of several inches in thickness. This was formerly collected in large quantities by the Indians, and, after being dried in the sun, rubbed between the hands and roughly winnowed, was crushed in a stone mortar, and made into a sort of bread, which furnished an important article of food. This insect, which has been described as a white grub, is also found abundantly in the waters of Great Salt Lake, Utah, and those of other saline and alkaline lakes of the West, and appears to be the larva of a two-winged fly which is described by the late Prof. Torrey under

the name of *Ephydra Californica*, and by Dr. A. S. Packard as *Ephydra gracilis*.[1]

A specimen of water taken from Owen's Lake, in January, 1866, had a specific gravity of 1.076, and contained 7128.24 grains of solid matter per gallon. The composition of this residue was found, calculated on an imperial gallon, to be as follows:

Chloride of sodium	2942.05
Sulphate of sodium	956.80
Carbonate of sodium	2914.43
Sulphate of potassium	122.94
Phosphate of potassium	35.74
Silicate of potassium	139.34
Organic matter	16.94
	7128.24

In addition to the substances above enumerated, iodine was present, but only in such minute proportion that its amount could not be estimated. It is also to be observed that since, for convenience of carriage, the sample of this water operated on was reduced by evaporation to one-fourth of its original bulk before being brought to this country for analysis, it is probable that some alkaline sesquicarbonates may have been originally present.

The incrustations which at certain periods of the year accumulate to the extent of many hundreds of tons on the shores of this lake mainly consist of carbonates of sodium, in which the proportion of sesquicarbonate is somewhat variable; in some specimens examined monocarbonates were alone present. Besides carbonates of sodium, these deposits contain three per cent. of chloride of sodium, and about five per cent. of sulphate of sodium, together with traces of silica.

It was proposed some years since to erect works on the eastern shore of Owen's Lake, for the purpose of refining this deposit, for the manufacture of merchantable carbonate of sodium; but whether this idea was ever carried out, I am not aware. The only serious obstacles to the success of such an enterprise would appear to arise from scarcity of fuel, and the great distance of the lake from a shipping-port.

As this lake continuously receives the waters of a considerable and constantly-flowing river, while it has no apparent outlet, it follows that it must act the part of a huge evaporating basin, in which the salts introduced by the not apparently saline water of Owen's River become concentrated to an alkaline brine. The rocks on either side of the valley through which the river flows are, to a very large extent, composed of granites, lavas, and basalts, from the decomposition of the feldspars in which the alkaline salts of the lake have doubtless been derived. The very small proportion of potassium salts present in these waters is remarkable, for although, from the circumstance of the feldspars of the district being to a large extent triclinic, sodium might be expected largely to predominate, still so great a disproportion in the respective amounts of the two alkalies could scarcely have been anticipated. This circumstance may perhaps, to some extent, be accounted for by supposing the potassium salts to have been largely assimilated by plants during the percolation of the waters containing them through vegetable soil, while the salts of sodium, not having been thus arrested, have passed into the river, and thence into the lake.

Owen's, like Mono Lake, was at one time much more extensive than it is at present; this is evident from the occurrence of a series of parallel terraces, plainly traceable on each side of the valley. In addition to these lakes, numerous alkaline lagunes and boiling springs are met with throughout this region.

The *Artemia fertilis*, before referred to as being plentiful in Mono Lake, is also exceedingly abundant in Owen's Lake. A peculiarity of this crustacean is, that it congregates into masses which have often a strange appearance in the water. These masses sometimes stretch out in such a way as to have the form of a serpent, while at others they represent circles or various irregular figures. A gentle breeze scarcely affects water filled by *Artemiæ*, so that while on all sides the water is slightly ruffled, that which is occupied by these dense aggregations remains perfectly smooth, thus indicating the figure of the mass. On placing some of these crustaceans in a bottle filled with lake-water, for the purpose of preserving them for subsequent microscopical examination, it was found that those which died rapidly disappeared, and on closely examining what had taken place, it soon became evident that as soon as vitality had ceased chemical action was set up, and the animal gradually dissolved in the strongly alkaline brine.

Burton Springs are situated at the extreme northern point of Owen's Valley. These springs rise from the earth over an area of about eighty square feet, which forms a basin or pond that pours its heated waters into a narrow creek. In this basin a vegetable growth is developed at a temperature of about 160° Fahr., and is con-

[1] *See* Hayden, "Geological Survey of Montana, Idaho, Wyoming, and Utah," 1872, p. 744.

tinued into the creek to a distance of about a hundred yards from the springs; where, at a temperature of about 120° Fahr., the algæ grow to a length of over two feet, looking like bunches of waving hair of a beautiful green color. Below the temperature of 100° Fahr., these plants cease to grow, and give way to a slimy fungus, which is also green in color, but finally disappears as the temperature of the water decreases. Dr. J. H. Wood, Jr., who has carefully examined this growth, makes the following observations with regard to it: "This plant certainly belongs to the *Nostochaceæ*, and seems a sort of connecting link between the genera *Hormosiphon* of Kützing and *Nostoc*.

"The best algologists now refuse to recognize the former group as generically distinct, and the characters presented by this plant seem to corroborate this view.

"The species appears to be an undescribed one, and I would propose for it the specific name *Caladarium*, which is suggested by its place of growth." [1]

Twenty miles south from Owen's Lake across a sage-brush and grease-wood waste, the surface of which is plentifully strewed with fragments of lava, pumice, and basalt, is Little Lake. This sheet of water, which is of comparatively small extent, is surrounded by huge masses of contorted vesicular lava, and evidently occupies the cavity of an ancient volcanic vent. The waters of this lake are considerably less alkaline than those of Owen's Lake, but bubbles of carbonic acid make their way to its surface in almost uninterrupted streams.

Fifteen miles east from this point are numerous hot springs; the path for the greater portion of this distance lies over lava-flows, which render traveling slow and fatiguing. At the principal group of springs the ground is covered, over a large extent, by innumerable cones of plastic mud, varying in height from a few inches to several feet; these rise above the surface of a seething swamp, and give issue to steam and jets of boiling water. In some cases the steam and gases, instead of issuing from cones as above described, are evolved under the surface of water and mud contained in basin-shaped reservoirs formed in the decomposed rock. By these means are produced multitudes of boiling caldrons in which violent ebullition keeps clay in a constant state of suspension; this clay varies in color from bluish gray to bright red. The waters of these springs are much employed by the Indians as an embrocation for the cure of diseases of the eye; on examination they were found to contain forty-eight grains of solid matter to the gallon, of which amount twenty-six grains are sulphate of aluminium; in addition they contain lime, soda, potash, and a little free sulphuric acid.

[1] *Silliman's Journal*, vol. xlvi., 1868, p. 33.

Borates of sodium and calcium occur in various localities in North America. The two borax-lakes are both situated near the shores of Clear Lake in Lake County, California, seventy miles northwest of the port of Suscol, and one hundred and ten from the city of San Francisco.

The larger of these lakes is separated from Clear Lake by a low ridge of volcanic materials loosely packed together, and consisting of scoriæ, obsidian, and pumice; it has an average area of about three hundred acres. Its extent, however, varies considerably at different periods of the year, as its waters cover a larger area in spring than during the autumnal months. No stream flows into its basin, which derives its supply of water partly from drainage from the surrounding hills, and partly from subterranean springs discharging themselves into the bottom of the lake. In ordinary seasons its depth thus varies from five feet in the month of April to two feet at the end of October.

The borax occurs in the form of crystals of various dimensions, imbedded in the mud of the bottom, which is found to be most productive to a depth of about three and a half feet, although a bore-hole which was sunk near its centre to the depth of sixty feet afforded a certain amount of the salt throughout its whole extent.

The crystals thus occurring are most abundant near the centre of the lake, and extend over an area equivalent to one-third of its surface; they are, however, also met with in smaller quantities in the muddy deposit of other portions of the basin. The largest crystals, some of which are considerably above a pound in weight, are generally inclosed in a stiff blue clay, at a depth of between three and four feet; and a short distance above them is a nearly pure stratum, from two to three inches in thickness, of smaller ones; in addition to which crystals of various sizes are disseminated through the blue clayey deposit of which the bottom consists.

Besides the borax thus existing in a crystallized form, the mud itself is highly charged with that salt, and, according to an analysis by Dr. Oxland, affords, when dried, in those portions of the lake which have been worked (including the inclosed crystals), 17.73 per cent. Another analysis of an average sample, by Mr. G. E

Moore, of San Francisco, yielded 18.86 per cent. of crystallized borax. In addition to this the deposit at the bottom of the other portions of the basin, although less productive, still contains a large amount of borax.

Water collected from Borax Lake, in September, 1863, was found by Mr. Moore to contain 2401.56 grains of solid matter to the gallon, of which about one-half was common salt, one-quarter carbonate of sodium, and the remainder chiefly anhydrous borax, equal to 535.08 grains of crystallized salt to the gallon. Traces of iodine and bromine were also detected. A sample of water taken from the interior of a coffer-dam sunk in the middle of the lake, and which had been allowed to fill by percolation from the bottom upward, was found to be more concentrated, yielding 3573.46 grains of solid matter to the gallon, but it contained the same ingredients, and in nearly the same proportions as the water from the lake itself. When evaporated to dryness, this water yields a considerable quantity of finely-divided carbon, resulting from the various organic bodies which have been dissolved in it.

Mud from the bottom of Borax Lake is in high repute among the local Indians as an *insecticide*, and is used in the following way: The head of the patient is thickly plastered with mud, which is well rubbed in, and then allowed to become perfectly dry; when dry, it is removed by rubbing between the hands, and with it disappears the colony of parasites. Ordinary clay is, under pressure of circumstances, sometimes employed for this process of shampooing, but when alkaline or boracic mud is available, it is considered more efficacious.

When this locality was visited by me in 1866, borax was manufactured exclusively from the native crystals of crude salt, while the mud in which they were found was returned to the lake after a mechanical separation of the crystals by washing. The extraction of boracic mud was affected by the aid of sheet-iron coffer-dams. The only apparatus employed consisted of a raft, covered by a shingled roof, provided with an aperture in its centre about fifteen feet square, above which were hung, by suitable tackle, four coffer-dams, each six feet square in horizontal section, and nine feet in depth. This raft, or barge, was successively moored in parallel lines across the surface of the lake, and at each station the four dams were sunk simultaneously by their own weight into the mud forming the bottom.

When they had thus become well imbedded, the water was baled out, and the mud and crystals removed, by means of buckets, into rectangular washing-vats, into which a continuous stream of water was introduced from the lake by Chinese pumps, the contents being at the same time constantly agitated by the aid of wooden rakes. In this way the muddy water continually flowed off, finally leaving a certain amount of crude borax at the bottom of each tank; this was purified by recrystallization. From the density acquired by the 70,000 gallons of water daily employed for this purpose, it is evident that only about one-half of the borax existing in the form of crystals was thus obtained, while the mud was again returned to the lake.

Instead of the coffer-dams, a small hand-dredging machine, worked, like the former, by Chinese labor, was subsequently introduced; but the mud brought up by it was subjected to the wasteful process of washing before described.

The crystals of crude borax thus daily obtained amounted to about 3,000 pounds; these were dissolved in boiling water, and recrystallized in large lead-lined vessels, from which the purified salt was removed to be packed into boxes, each containing 114 pounds, in which it was forwarded to San Francisco. The loss of weight experienced in the process of purification amounted to about thirteen per cent.

Shortly after my visit in 1866, the manufacture of refined borax at Big Borax Lake was suspended, and I am not aware whether it has now been resumed, but the works do not appear to have been in operation in 1874.

Little Borax Lake covers an area of about thirty acres, and is usually dry during the months of September and October; it is then covered by a white crust, which is collected by Chinese laborers and carried to the works, where it is refined by recrystallization. *Ulexite*, a double borate of sodium and calcium, is brought to this place from Wadsworth, in the State of Nevada—a great distance, with several transshipments—to be treated at these works; it appears that on account of the presence of carbonate of sodium, and the cheapness of fuel, this can be done more cheaply here than in Nevada.

Clear Lake is a large and picturesque sheet of water, twenty-five miles long, by about seven wide, surrounded by mountains, which in many places rise abruptly from the water's edge. Boat-life on this lake is delightful; the water is smooth, there is usually a sufficient breeze for sailing, and should it fall calm, an Indian can always be hired to row.

Lying about a mile beyond the ridge which

borders Borax Lake on the northeast, and at the foot of a shorter arm of Clear Lake, which extends off to the southward parallel with the larger one, is an interesting locality, known as the "Sulphur Bank." It is some six or seven acres in extent, and consists of a much-decomposed volcanic rock traversed by innumerable fissures, which has become almost covered by a large accumulation of sulphur.

From the fissures steam and gas are constantly issuing, and over and through the mass large quantities of sulphur have been deposited in such a way that at a short distance the whole bank appears to consist of this substance. Into some of these cavities a pole may be inserted for a distance of several feet, and they are often lined with stalactites and beautiful crystallizations of sulphur.

Sulphur is being constantly deposited, and its deposition is attended by the evolution of carbonic and boric acids. The gaseous matters issuing from these crevices appear to be the agency by which the various substances now deposited in the cavities have been brought to the surface. Sulphur is deposited on the sides of the various fissures either in the form of crystals or as amorphous, translucent masses of a beautiful yellow color. It is sometimes intermixed with cinnabar, the presence of which was first discovered by Dr. Oxland; but more frequently with minute cubical crystals of iron pyrites. Pulverulent silica, blackened by some hydrocarbon resembling coal-tar, is also frequently observed.

On the sides of the cavities colloid silica is found coating chalcedony and opalescent quartz in the various stages of formation, from the gelatinous state to that of the hardest opal. The indurated material is sometimes colorless, but is more frequently permeated by cinnabar and iron pyrites, or blackened by the tarry matter before referred to. Cinnabar is also found in laminæ, and occasionally even in veins and concretionary masses of considerable thickness.

In addition to being employed as a source of sulphur, this deposit has been worked for quicksilver, and has produced large quantities of that valuable metal.

On the shore of Clear Lake, near the sulphur-bank, is a hot spring, of which the outlets, even when the water is low, are partially beneath the lake, so that the amount flowing from it cannot be ascertained. Hot water, however, rises through the sand at various points extending over a considerable area. A specimen of water collected by Mr. Moore from this spring was found by him to contain 184.62 grains of common salt, 76.96 grains of bicarbonate of sodium, 36.37 grains of free carbonic anhydride, 103.29 grains of borax, and 107.76 grains of bicarbonate of ammonium, in an imperial gallon; besides silica, alumina, and traces of various other substances.

Prof. Whitney remarks with regard to this spring: "The most extraordinary feature in the above analysis is the very large amount of ammoniacal salts shown to be present in this water, in this respect exceeding any natural spring-water which has ever been analyzed. Mr. Moore thinks that, as in the case of the boracic-acid waters of Tuscany, ammoniacal salt may be separated and made available for economical purposes. This locality is worthy of a most careful examination, to ascertain how considerable a flow of water can be depended on." [1]

Dr. A. Blatchly, of San Francisco, in speaking of the geyser group of quicksilver-mines, says: "Nearly all these veins contain iron in considerable amounts, frequently in sufficient quantities to constitute an ore of iron. Gold, silver, and copper, are also frequently constituents of these lodes, and occasionally chrome-iron in considerable quantities. But, so far as is known, in no instance have the precious metals been sufficiently abundant to pay for the expense of extraction.

"Bitumen is found in nearly all these veins, sometimes a deposit of a gallon or two in one cavity.

"Thermal springs are numerous throughout the whole quicksilver-region, and the uniformity of their occurrence leads prospecters to the belief that there is an intimate relation between the causes which generate thermal springs and produce deposits of cinnabar, and that where one is found the other may probably occur in the vicinity." [2]

On the eastern slope of the Sierra Nevada, near Walker's Pass, borax is found in what appears to be the bed of an ancient lake, large crystals of this substance having been met with in a hardened mud, exactly resembling those found in the blue clay of Borax Lake. By far the largest amount of borax is, however, obtained from the indurated mud, where it exists in common with other salts. This mud, from which borax is separated by lixiviation, contains about half its weight of that salt, and is a light, clay-like body, having a strongly saline and al-

[1] "Geological Survey of California," p. 100.

[2] "Mineral Resources west of the Rocky Mountains," 1875, p. 176.—Raymond.

kaline taste. The portion insoluble in water effervesces on being attacked by hydrochloric acid, and contains silica, alumina, lime, ferrous oxide, and magnesia. Similar deposits containing borax exist in Panamit and Death's Valley, in Lower Nevada; but these desolate districts have not as yet received so careful an examination as they deserve.

About twenty miles west of San Bernardino is the so-called "Cane Spring District," where ulexite or boronatrocalcite is found, over an area about ten miles in width by fifteen in length. The surface of the ground is covered by effiorescent salts, commonly known as "alkali," beneath which the borax salts (chiefly ulexite) are found at a depth of only a few inches.

At Hot Springs, in the northwestern portion of the State of Nevada, at a height of 4,500 feet above the level of the sea, and where the water issuing from the ground has a temperature of about 190° Fahr., there are deposits of boronatrocalcite, extending over considerable areas. Here, as far as the eye can reach, nothing is seen but barren mountains, formed of a black, porous lava; while the valleys are covered by an efflorescence of a mixture of common salt and sulphate and carbonate of sodium. In other cases the sands of these mountain-valleys contain deposits of more or less pure boronatrocalcite.

Geysers and hot springs are numerous in the whole of this district, and from the number of extinct geyser-vents still visible they were, probably, at one time much more numerous than at present.

The analysis of an average sample of the boracic material from Nevada afforded Mr. Loew the following results:

Boronatrocalcite	22.13
Chloride of sodium	2.80
Sulphate of sodium	2.62
Sulphate of calcium	6.17
Carbonate of calcium	3.01
Carbonate of magnesium	.79
Clay	19.70
Quartzose sand	26.03
Water	15.04
Traces of potash, iodine, and loss	1.71
	100.00 [1]

[1] *Moniteur Scientifique*, 1876, p. 1230.

The purification of crude borax (*tincal*) is effected by a simple recrystallization, but the preparation of marketable borax from boronatrocalcite is attended with considerable difficulty, more particularly as the appliances available in the remote deserts in which it occurs are of the most primitive and limited description.

When boronatrocalcite is moderately pure it is first ground and subsequently dissolved in water, with the addition of an amount of carbonate of sodium sufficient to effect the decomposition of the calcic carbonate present.

The solution is subsequently heated, and the carbonate of calcium allowed to subside, when the liquor is drawn off, and, after concentration, borax is obtained by crystallization.

Unfortunately, this mineral often contains notable quantities of gypsum, which transforms an equivalent amount of carbonate of sodium into Glauber salt, a relatively valueless product. This salt is also frequently present in the material operated upon, and thus materially adds to the difficulty of treatment. In order to avoid these difficulties, it has been proposed to treat native boronatrocalcite with sufficient sulphuric acid to transform the whole of the carbonate of calcium into gypsum, and to liberate boric acid to be subsequently saturated by carbonate of sodium. Boronatrocalcite has also been treated with excess of hydrochloric acid, in order to obtain crystallized boric acid, but neither of these processes has hitherto afforded satisfactory commercial results.

The comparatively recent discovery of large quantities of this substance in Nevada will, no doubt, eventually, to some extent, affect the Tuscan producers of boric acid; but the fact that crude boronatrocalcite varies considerably in its composition, and that it is found in situations in which its local treatment would be almost impossible, has hitherto prevented this mineral from being extensively employed as a source of commercial borax.—*Popular Science Review.*

DEAF, BUT NOT DUMB.

By B. ST. JOHN ACKERS.

WHY am I standing before you to-night? Why am I reading this paper on the "deaf and dumb" before your honorable Society? Not as a schoolmaster wishing to bring before your notice some special method of teaching that he himself invented; not as a medical man wishing to advocate some special treatment of ear-diseases; not because, in fact, I have any claim to speak in my own person as a professional practitioner, either scholastic or medical, but solely because that has happened to me which might happen to any one here present: illness came upon my only child; its life was spared, but its hearing lost.

Great, indeed, were the difficulties we experienced in deciding on the best way of educating our child; meagre, indeed, the help we could obtain in our own country. I am desirous that others should have the benefit of our experience, so that no one need go through the terrible uncertainty and anxiety we had to endure. Our child was three months old when a severe attack of fever took away her hearing. For a year or two we kept hoping on. I even refused to enter the child in the census as "deaf and dumb." I would not "brand" it as long as there was any doubt. Such was my foolish pride; such is the foolish pride, alas! of very many; and it is mentioned here in order to show that this, among other causes, makes the census-returns of the "deaf and dumb" below the real number. As soon as our child's loss of hearing was beyond question, we brought her here to London for the best medical, surgical, and educational advice. We hoped—indeed, we never doubted—that we should have received the best advice about the education of our child from those of the medical profession whom we consulted. But such was not the case. Sad and disappointed, we turned to those who had devoted their lives to the education of the deaf. Here, at least, we expected to be assured beyond doubt of the best method on which to instruct her; but again we were doomed to utter disappointment. We found different systems at work, and the advocates of each said very hard and bitter things of one another. Here it will be well to explain the technical terms that will be used in this paper. For want of this, it is sometimes difficult to understand the meaning of many works on this subject, as different terms are used by various writers and speakers to express the same things, and the same terms to express different things.

"Deaf and Dumb." Those wholly uneducated, or who cannot hear or speak, though educated, or partially so.

"Deaf." Those who cannot hear or speak before they have been educated, or who, having been educated, are still without hearing, but can speak.

"German" System. That which is based on articulation and lip-reading.

"French" System. That which is based on a system of signs.

"Signs." All, except

"Natural Signs;" which I define as such as hearing persons use and can understand—e. g., "come," beckoning with the hand; "go," motioning away with the hand—which are really actions, not signs.

You may wonder why we did not test for ourselves the results obtained by the various methods in this country. We would willingly have done so, but the "German" system had not been long enough at work to prove the value of its teaching to pupils in general after leaving school, and we were assured by the "French" system teachers—the "old" system, as it is so often erroneously called by Englishmen, simply because in this country it has been the longer established—that, however good the "German" might appear in school, the speech and lip-reading there learned were of no value in after-life.

We could not disprove this assertion. Nay, we were inclined to believe it, for, we said to ourselves, as so many do now, "if it be the better method, surely it would have been adopted by such a practical nation as our own long ago." Of this I must speak hereafter.

It will be seen that, to persons considering this subject for the first time, as we were, it was impossible to arrive at a satisfactory conclusion—one that would leave no doubt on their minds—without going into the world to find out the truth. So, without loss of time, in August, 1872, our child being three years old, we left her with my wife's family, and commenced investigation for ourselves. We visited some of the principal schools in each of the following countries, in the order named: England, United States, Canada,

Great Britain, Holland, Belgium, Germany, Saxony, Bohemia, Austria, Bavaria, Switzerland, Savoy, and France.

The subject before you naturally divides itself into three heads—Medical, Historical, and Educational.

Time will not allow me to-night to enter upon the medical and historical aspects of the case, interesting as they are, even more so, probably, to the general public, than the educational view of the subject. This paper, however, must be confined to this latter portion of the question, viz., education.

Education.—Chiefly as bearing on the results of the different methods of education on the pupils in after-life.

Let it be clearly understood that the term "deaf and dumb," as used in this and all countries where the "French" system is adopted, includes the toto-congenital—those born wholly deaf; the semi-deaf—those with partial hearing; and the semi-mute—those who have spoken before loss of hearing. This term "deaf and dumb," used for such degrees and classes of affliction, is very confusing; the different conditions are often misunderstood, and much evil arises therefrom.

There are three systems of teaching the deaf —"German," "French," "Combined."

The "German" system teaches by articulation and lip-reading; the "French" by signs, dactylology (i. e., the manual alphabet), and pantomime.

Writing and pictures are, of course, common to each system. It is true that in "German" system schools natural signs are used at first, but they are dropped as soon as the pupils have learned to express their meaning in words; and, on the other hand, in "French" system schools some few pupils are taught articulation. The "German" system teaches the pupils from the first to think in the order of the language of their country, whereas the "French" system teaches the pupils to think in the order of the language of signs, which is an inverted order, as far as English and all other European languages go—e. g., "cart draw horse." It also ignores particles, and other things necessary to ordinary English.

The "Combined" method is so called because it tries to combine parts of each of the two great opposing systems. The teaching, however, being based on signs, is far nearer the "French" than the "German" system, though some articulation is attempted at first with each pupil—a system which has brought, and always will bring, articulation into disrepute; for it is useless to think of teaching articulation successfully unless it be, as in the "German" system, the basis of instruction; so that the pupil may always think and express ideas in the order of the language of his country. This is next to impossible for him to do, when taught upon any system which is based on signs. Signs are also much easier than articulation to the deaf. The two have nothing in common. The easier will always supersede the harder in the affection and practice of the pupil.

Now, it would be well, before going any further, to get rid of the idea so common among hearing people, that children "deaf and dumb" are quite different from others. For instance, it is often imagined that they must be of weak intellect. This is a great mistake. True, some have not full mental development, which is not to be wondered at, when the causes of congenital and accidental deafness are remembered; often it is a fever that takes away hearing, and leaves mind and body in an enfeebled condition. Such, however, is just as often the case with hearing children after suffering like maladies. The brain is uninjured in the vast majority of the deaf, and is exactly the same as that of hearing children.

Another very common fallacy is, that the child does not speak—is dumb—on account of some malformation of the vocal organs. Now, this is so rare a case if indeed, it exist at all, that it cannot be classed as one of the causes of dumbness. Indeed, there are but two causes, so far as I know, of absolute dumbness, viz., want of brain-power, and deafness. As the latter causes dumbness only on account of want of proper education, the former is the only true cause. The term "deaf and dumb" is really an unnatural and artificial one, expressing not the action of Nature under favorable circumstances, but the result of neglect.

It is not uncommon to meet with dumb persons who have their hearing perfect; their dumbness arises from defect of brain. But what I have never met with is dumbness from deafness, except through disuse of voice. There is no such thing as a child born dumb because deaf. The born deaf are at first exactly the same as hearing children; they cry, sneeze, cough, crow, laugh, ay, and talk too, like hearing children. This may seem very startling; but, startling though it be, it is true. The born deaf do talk, in their own baby-language, just like hearing children of the same age, only we do not understand them. What mother understands all her hearing baby

says at first? But, it will be said, "even if this be so, hearing children can understand all that is said to them, and that is what deaf ones never can." Really! Can hearing children understand all that is said to them? Then why do mothers and nurses say the same thing, over and over again, a hundred times? And when the hearing child can imitate what is said to it, does it therefore know the meaning? Does it know what "papa" or "mamma" means, because it can say the words? Of course not.

The objects must be shown with the words spoken, and shown over and over again, too, before the hearing child can connect the object with the spoken word; and so—exactly so—is it with the deaf child; you do not let it go on talking its own language; but, just as with the hearing, you educate it to repeat certain sounds after you, and to connect those sounds (spoken words) with certain objects—only with the deaf you cannot teach through the ear, and so must through the eye. It is all by imitation, as with the hearing child; it does not "come natural," as unthinking people so often say, either to the hearing or to the deaf.

Now let us contrast the effect of these systems on the after-life of those educated thereon. We will take the "French" system first, as that best known in this country. I have said over and over again, and here repeat, that if the object of the education of the deaf were to fit them to live in large asylums and comfortable institutions, they should by all means be educated on the "French" system. It is the easiest and pleasantest to the pupils, so long as they are together or with their teachers. But we know well that institution-life can be but the lot of very few. Almost all have, before long, to leave what has to them become a happy home, where every one understands and uses the language of signs, and to take their place in the world and earn their daily bread. Here they scarcely meet with any one able to use the language of signs, and very, very few who know the finger-alphabet. But it may be said, "They have writing." Yes, but what does this amount to?

However much knowledge or education may be justly claimed for the deaf-mute instructed upon the "French" system of signs, still such knowledge is to hearing persons in a great measure a sealed book, by reason of the want of a proper communication between the two classes; the deaf-mute, in consequence of the peculiar nature of his instruction, which gives him language in an inverted order, has a difficulty in making himself understood by writing, and in comprehending the writing of ordinary hearing persons. His own knowledge of language is very imperfect, and few of those with whom he daily associates are sufficiently educated to read or write with comfort, and many, we know, cannot do so at all.

Now let us pass to the "Combined" method. This is the system that Gallaudet, the first teacher of the deaf in America, found in this country, and erroneously supposed to be the "German" method. He took this for granted, because articulation was taught. He failed to appreciate, as so many do now, the cardinal difference of these systems. It is this, that under the "Combined" method a system of signs is the basis of instruction, articulation being only an accomplishment, just as modern languages were taught in our old public schools, with the result we all know: the thing was looked upon by the boys as a "bore," and the knowledge (or rather want of knowledge) of these languages so gained, and the little use they were in after-life, have passed into a by-word.

Those thus taught never feel at home in speaking, find great difficulty in making themselves understood, and so soon cease to continue the attempt. So it is with those taught on the "Combined" method. Articulation is to them a "bore;" they find people outside their schools unable to understand them, and so they, too, soon cease to make the attempt.

Thus articulation is brought into discredit, not by its being in any way unsuited to the deaf, but because it has been treated as an accomplishment.

Indeed, the case of those thus educated practically differs but little from those under the "French" system, but that little is not in favor of the "Combined" method. In examining the pupils taught on this system, we find them the least educated, and the reason was not far to seek; for the pupils so taught were taken away from the rest to learn articulation, it may be half an hour a day, more or less. What were the constant remarks of the teachers? Why, that "the articulation-pupils were behind the others." And no wonder; for whatever takes the pupil away from his companions regularly for ever so short a time, be it articulation, drawing, Latin, or any other thing foreign to the ordinary work of his class, must have the effect of making him show to disadvantage with his classmates, whose attention and time

have not been disturbed. But, it may be argued, "Could not more time be given to articulation?" It would be of no avail, I reply, so long as signs constitute the basis of education, for so long will the pupils think in them rather than in articulation. In that case no good result is to be gained, because articulation will be but a foreign language, in which ease enough to be pleasant or useful will rarely be gained, an annoyance very often—a task, and will ever lead to disappointment.

A "foreign" language! Is it not startling to hear English spoken of thus, in the case of English children? Yet such is English to those taught on the "French" or "Combined" methods. It is a foreign language to them, as we are constantly reminded by the teachers of those systems. Let us see whether such is the case with those taught on the "German" system.

Here, to begin with, there is no inverted order; and, as those taught thereon have no other medium for thought than the English language, there is certainly no reason, theoretically, why their language should not be as pure as that of hearing children. This is scarcely the case at first, yet such a result is reached before leaving school, and is not lost afterward.

I fancy I hear some one say, "This may be so with the semi-mute and the semi-deaf, but can it be possible with the toto-congenital, who have never heard? Are they able to make speech the means of communication with the world in general?" Wait a minute, and I think, when you have heard a few examples of the very many cases that have come under our notice, and which we tested for ourselves, that you will acknowledge that articulation under the "German" method is no mere accomplishment, but is the practical means by which those so taught communicate, not with their fellow-pupils and teachers only, but with their hearing fellow-creatures also.

Remembering the three classes called "deaf and dumb" in this country, let us take a few examples, all of which came under our personal notice, unless mentioned to the contrary. In these cases names and dates will not be specified, but they are at the service of any person who chooses to ask for them for the purpose of proving the accuracy of the statements contained in this paper.

I will not weary you with cases of the semi-deaf speaking, because it must be evident to all that this class—having hearing, although not sufficient to enable them to be educated with hearing children—have ear enough to understand to a certain extent the modulations of sound. We will pass on, therefore, to the next class, the semi-mute.

The first case we will take is that of one of the daughters of a gentleman who, through his kindness to us, has become a great personal friend of my own. As soon as he heard the object of our journey, and that our child was deaf, he spared neither pains, time, nor personal exertion to help us in this matter.

His child had lost hearing, from fever, between four and five years of age. At that time there were no schools in this country on this admirable "German" system; but the parents, convinced of the advantage of this method, made themselves acquainted with the details of instruction, which were successfully carried out in the person of their own child, as you will acknowledge when I tell you that she was able to go into shops in Germany and get things that her father wanted, he being unable to speak the language; and that she came to stay with us in our house in the country, and was conversed with by our friends, both at garden parties and privately, to the surprise of all who saw her.

Take another case. A lady of great wealth had four children; fever came and struck down three; two died, the other lived, but her hearing was totally lost. She was then four years of age. The poor mother, as might be expected, was overwhelmed with grief, and for twelve months was herself ill, and unable to attend to the education of her poor little deaf child. It was not until the latter was between five and six years of age—twelve months after losing hearing—that the mother attempted to educate her at all. Her speech was almost gone; indeed, to such an extent was this the case, that she had but one word left—a word natural to a child—"cake." The mother was an energetic, clever woman, no doubt, but she had a large household, and kept much company, living in the most fashionable society of a wealthy neighborhood; yet she found time to educate her child, notwithstanding that a large younger family (she had eight living children when I saw her), added to her other cares, must have left her little time for such teaching. She made a practice of giving her deaf child two hours every morning, and with this instruction her daughter became a highly-educated and agreeable woman in society. We spent the day at her father's house, and a most accomplished woman we found her. She talked to my wife of pictures, poetry, and all manner of subjects common to

ladies, such as needlework, etc. To me she talked of riding (she was a great horsewoman), billiards, and other topics she thought would interest me, explaining the difference between their game of billiards and ours, giving me the names of the different woods the cues were made of, and conversing with me as freely as though she had been a hearing person; indeed, several times during the day my wife forgot that she was speaking to one deaf, so accurately did this deaf young lady read everything that was said to her when she could see the speaker's face; but occasionally my wife, forgetting this, turned away, and of course received no answer. Yet had she been sent to a "French" system school, all speech would have been lost. There would have been no attempt made to keep up, or restore, the speech of a child so young; and one more would have been added to the long list of the dumb.

The next and last case of a semi-mute—well known, but which did not come under our own observation—is that of a man who went through part of the civil war in the United States as a private soldier. He spoke so well, that for some time the secret of his deafness was undiscovered. One night, however, he was challenged by a sentry, and, taking no notice, was wounded. This led to discovery, and he had to leave the army. His early history is interesting and instructive, and I will give it almost in his own words as told to a friend of mine. He lost hearing through fever at five years of age, but retained his speech. His friends communicated with him by writing. One day, sitting on the floor, he watched his father and a neighbor talking, and when the neighbor left, he looked up and said, "Did not Mr. —— say so-and-so?" "Yes," said his father; "how do you know—who told you?" "Father, I saw his lips move, and I guessed that was what he said." "You had better practise watching people's lips," his father said. The "German" system was then unknown in America; but the boy did practise, both with his family and by studying his own lips before the glass. The only difficulty being that he soon discovered a difference in his own pronunciation of words ending in "tion," as he called it "ti-on," and such like spellings, where the sound and the spelling did not agree. At twelve years of age he was sent to the American asylum at Hartford, and for a whole year he could make absolutely nothing out of the signs and finger-talking used around him. This made him very wretched. He continued to say his lessons aloud to the master, who questioned him on his fingers. One day, going to his master for the meaning and pronunciation of some new and difficult word, the master, in a fit of impatience at his not pronouncing it rightly, wrote the word down, spelling it phonetically; the boy at once gave it correctly, and his delight and joy were intense. Here was the key of knowledge. From that day he always went to others with his new words, with the request, "Spell it wrong—spell it as it sounds," and he had no more difficulty. He married a deaf-and-dumb woman, and had several children, all of whom heard. When these children were old enough they were sent to school. Very soon a complaint came to the father from the teacher, his children were so remarkably impudent and naughty they would write nonsense on their slates instead of their exercises. They had been punished, but continued to bring such sentences as this, "Man horse black on riding was," and, if he did not use his authority to stop this, the children must be expelled. He at once wrote, explaining that they had been in the habit of communicating chiefly with their deaf-and-dumb mother, who employed signs, and this inverted language was the consequence. If no notice were taken, but the children allowed to mix freely with their schoolfellows, he had no doubt their language would right itself, and so the event proved.

We now come to the last of the three classes of the so-called "deaf and dumb"—the toto-congenital. How these educated on the "German" system were able, after leaving school, to get on in the world by articulation and lip-reading, was, you may remember, the great object of our inquiries. This point is all the more important now, as the advocates of the "French" system allow in theory, however little they carry it out in practice, the value of teaching articulation to most of the semi-mute and semi-deaf, but still deny the use of attempting it with toto-congenitals, except in very rare instances.

Now as to those who have left the "German" system schools. We saw specimens of these, some in workshops, some milliners, some married to hearing persons, some at home with their parents, some master tradesmen, etc.; all, I again remark, were toto-congenital—such as would be termed in America, France, and England, "deaf and dumb." The result was encouraging beyond anything we had dared to hope. Had we expected to find old pupils that "one would not have known from hearing persons," we should have been disappointed. There may be such, but we have never been able to trace any, nor

did we ever meet with a "German" system teacher who knew of one—that is, a toto-congenital pupil, old or present, that habitually, or for any length of time, could pass as a hearing person. But what we did see, were men and women able to earn their own livelihood in trades and other occupations, communicating with and answering hearing persons sufficiently well by articulation and lip-reading to go through the world comfortably, and, in some instances, very successfully. In no case were we unable to make ourselves understood, or failed to understand in return, except when with those educated in a school where some signs were allowed, a large "internat."

Just in proportion as signs were allowed in institutions, so those taught therein appeared to less advantage when we saw them in after-life. We asked their fellow-workmen, their employers, their work-people, their relations, and those with whom they lodged, "How do they communicate with hearing persons?" and were universally answered, often with embarrassing astonishment at such a question, "Why, by speaking, of course!"

Let us take a few individual cases. That of the Dutch gentleman, who kindly allowed himself to be examined and tested in this room, and before the Social Science Congress at Leeds in 1871, is probably known to most here present. Of him Dr. E. M. Gallaudet, the Principal of the National College for Deaf-Mutes, at Washington, U. S. A., not too willing a witness, declared that he and the Dutchman before-mentioned had no difficulty in conversing together on various topics by word of mouth, not even the jolting of the cab on their way to the station making any difference in the ease with which they understood each other.

But let us pass on to cases that came under our own notice. One, that of a poor woman living with an aunt, is worthy of special notice, showing, as it does, that the education given on the "German" system is good, and not lost afterward. She had left school some twelve years, and lived in a part of Germany where one of the many dialects prevailing in that country was spoken. Her aunt, a garrulous old woman, chattered at such a rate that my wife, though a good German scholar, was sometimes at fault, as was also the German lady who acted as my interpreter. More than once, when such was the case, my wife asked the deaf niece, whose purer German interpreted the sentence.

Another case was that of a young woman, who was a leading dressmaker in a small German capital. She was rather shy at first. On our mentioning this to the landlord of the hotel where we were staying, he called the hotel-porter, who was engaged to the deaf dressmaker, and told him we had not found his sweetheart very communicative; whereupon the porter begged we would, escorted by himself, give her another trial. So off we started, but met the young woman soon after we left the hotel. The meeting of the two lovers was most amusing. He took her roundly to task for appearing to so little advantage on our first acquaintance, and, after some lively sparring—rattled off between them just as though both, instead of one only, had been hearing persons—we chimed in, and had a long and pleasant talk. She assured us that, in following her occupation, the only means of communication between herself and those who employed her were articulation and lip-reading. Writing was never had recourse to; finger-talking and signs she did not understand.—Take another case.

We saw in Vienna a fancy-leather merchant, who employed seventy men under him, whose premises the Emperor and Empress of Austria visited before the great Vienna Exhibition, who could not only speak the language of his country fluently, but also a little English, who had visited England and other countries, was a practical horticulturist, and altogether an agreeable, intelligent, wealthy man—wealthy through his own educated talents and industry.

A good instance of the independence which pupils well educated on this system feel in after-life, was mentioned to me last year. A journeyman cabinet-maker had such a thorough command of language, that he told my friend he intended to seek work in other countries, and should settle in whichever he found gave him best employment, having no doubt of being able soon to talk the new language sufficiently. Not to weary you with more of the many other instances one could give, I will end this part by telling you, that we went into a hatter's shop in Friedberg who had a toto-congenital deaf workman. That very morning a man had been convicted for theft, principally on the evidence, given *vivâ voce* in open court, by that deaf workman, who stood the test of examination and cross-examination without any other method of communication being used than word of mouth.

After what you have just heard of the power of the "German" system, does it not seem strange that its introduction into this country

should have been opposed so strongly? Yet the same prejudice against the value of the system —taking the twofold form, either of utter disbelief in the power of the deaf to speak, because they are called "deaf and dumb," or, on the other hand, the deep-rooted idea that speech, when thus given, is not better than that of the parrot or the magpie—is widespread, as the following will show.

A gentleman in America had a child who lost hearing in her fifth year; he took her to the best institutions that he knew of in his own country. These were on the "French" system. He was there told he had better take her back, and bring her again when she was twelve. "What!" said he, "must she be seven years without any education? And what is to become of her speech? She has already lost some of her words." "Oh, that will soon be gone, and in a few months she will be as dumb as she is deaf." The parents were greatly hurt at this, and resolved that her speech should never be lost—a resolve which they succeeded in carrying out, by means of studying the "German" system. Finding the great benefit their child received from this method of teaching, the father endeavored to get a school established on this principle. For this purpose he applied for State aid—which is, I believe, freely afforded for the education of the deaf in every civilized country but our own. His application was refused. Twice his proposition was defeated in Congress; and it was not until he had publicly exhibited the system in the person of his own child, that the measure was passed. The opposition was led by a member of Congress, who himself had a toto-congenital deaf-and-dumb child.

When I was in America the school was large and flourishing, one of the warmest supporters and most active members of its committee being the very Congressman who had so long and successfully opposed its foundation. He told me himself that he felt he could never do enough to further the "German" system, in order to make amends for having kept its benefits from his native State so long.

Now we will go to a very different part of the world, and give you an instance of the prejudice which did exist against this system in Switzerland. For this purpose I will quote from the able report of Mr. A. A. Kinsey, made of a school at Riehen. He is the gentleman who has qualified himself, by residence and practical instruction in the best "German" schools in Germany, to preside over the proposed training-college for teachers of this system in England:

"In a little village called Riehen, about four English miles from Bale, in Switzerland, is to be found a most excellent school for the education of the deaf. I cannot refrain from advising any one reading or listening to the following story, if at some future time he happen to find himself at Bale, to drive over to Riehen and visit the 'Deaf and Dumb Institution' there. I promise him that he will be most cordially received, and, what is far more to the purpose, greatly astonished at what can be done with children stone-deaf from birth.

"This school has been in existence now thirty-six years, and is prosperous, but at the commencement of its career such could not be said of it; in fact, Mr. Wilhelm D. Arnold, the admirable head of this school, could with but the greatest difficulty and economy make both ends meet. Persons accustomed to support charitable institutions pooh-poohed it—looked upon it as the idea of a visionary—a waste of money, which might with greater advantage be used elsewhere. Foremost among such persons was a rich merchant of Bale, named Merian. This gentleman had occasion very often to visit Mr. Arnold at Riehen on business not connected with the school. On each of these visits, at the conclusion of the work in hand, Mr. Arnold would endeavor to interest his wealthy friend in the school, but always without success. He sighed to think how easily this rich man could place them out of all their pecuniary troubles, could he be but once convinced of the genuineness of the education. But how to do it was the question. He had talked, argued, quoted in favor of his school; had invited Mr. Merian to see and hear for himself. But, no; Mr. Merian had no time to waste in such an absurd manner; he was a strict man of business, and, the moment his business with Mr. Arnold was at an end, he would step into his carriage and be driven back to Bale. One day Mr. Merian, being, let us suppose, in a very good humor, or Mr. Arnold's entreaties to him to visit the school-rooms being more than usually strong, he consented just to give five minutes of his valuable time to an examination of the children. Crossing from the dwelling-house to the school, he grumbled out, 'You know it's all nonsense, Arnold! You know very well, as well as I do, that these children just talk like so many trained parrots. I don't deny they do talk—never did; but I simply repeat, they talk like parrots; and it's a downright waste of time teaching them to do so.' 'Well, well,' said Arnold, 'you come and judge for

yourself.' Mr. Merian continued: 'I never could understand how a man like you, so thoroughly conscientious and honest in all other respects, should be mixed up with such humbug, such charlatanry, as this.' 'Pray don't use hard words,' said Arnold, 'until you have satisfied yourself by proof that they are deserved.' Both gentlemen then entered one of the class-rooms together. All the children present rose, and greeted them with a 'good-day.' Mr. Merian broke out at once, 'There! I knew it; I told you what it would be: "Good-day!" "Good-night!" Pretty poll!"' A boy came up to him with a chair, saying, 'Will you be pleased to sit down, sir?' Mr. Merian sat down, but without thanking the boy for his politeness. What was the use of thanking one who couldn't understand?—a parrot, in fact—but said, 'Oh, yes, it's all very clever, Arnold; the boy has been well-trained in his lesson, but you can't blind me.' Mr. Arnold said to the class, 'This is Mr. Merian, of Bale.' Several children repeated the name, and bowed to him. This gentleman, however, broke out again, 'There! there! I can't stop any longer; it is nothing more than what I expected.' 'Well, one moment, if you must go,' said Mr. Arnold, 'while I ask the children one or two questions.' Turning to the class, he said, 'Did you see Mr. Merian come this morning?' 'Yes, we did,' answered several. 'Did he arrive on foot?' 'No.' 'How, then?' 'He came in his carriage.' Mr. Merian sat up in his chair, and paid somewhat more attention. 'Has Mr. Merian's carriage one, or two horses?' 'Two horses.' Mr. Merian said, hastily, 'Now, Arnold, you are deceiving me; you are telling them all this in some secret way.' 'Oh, no,' said Mr. Arnold, 'I never make use of signs, or the finger-alphabet; and if I did, I am truly happy to say my pupils wouldn't understand me. Besides, see, my hands are behind my back.' He went on: 'What color are the horses?' 'One is brown, with a white face, and the other is gray.' Mr. Merian jumped up, saying, 'This is very curious!'—looking from Mr. Arnold to the boy who had last spoken, and appearing puzzled—'this is really very curious! One might easily be deceived into fancying that the child was really thinking.' Mr. Arnold, without answering, went on, 'Why does Mr. Merian ride in his own carriage, instead of walking, or going by cart, as we do?' 'Because Mr. Merian is a very rich man, and can afford to ride in his carriage.' 'Why, Arnold, the child is thinking, I declare!' cried out the gentleman. 'Of course he is,' replied Mr. Arnold, quietly; 'they all think, and express their ideas as you and I do. True, not in such finished language, because, at present, their vocabulary, like that of all children, is limited; but I hope, by the time they are confirmed, they will be able to express themselves in as perfect language as, if not more so, than do their parents and relatives.' 'Well, put some more questions,' said Mr. Merian. This was done, and, after half an hour, he said: 'Arnold, why didn't you tell me about this before? Why did you leave me under such an erroneous impression?' 'My good friend,' answered Mr. Arnold, 'if I have told you once, I have told you a hundred times.' 'Yes, but you should have explained the matter properly to me, so that I could have understood it. But, there! I will come and see your school again to-morrow. I feel quite interested in the poor little things, since I find they can talk rationally.' He did so, and during the next month he was to be found for several hours, twice a week, listening to the pupils. The first time he put some questions vocally to one of the children, and received an answer, his delight was boundless. He felt almost that he was the wonderful instructor of the child; that he had placed the little deaf boy before him far above the reach of his sad affliction, and had given him the power to see that which others hear; that he himself had restored to the poor boy the Divine gift of human speech, temporarily lost, which, but for the untiring aid and skill of his teachers, would have been lost, indeed, forever.

"From that moment Mr. Merian made a resolution, and his resolution was good. He gave 32,000 florins for the purpose of educating six pupils annually; and lent his most willing assistance and influence to the method of instruction he had so long, through unreasoning prejudice, condemned and despised."

A similar noble instance is recorded in America, where a Mr. Clarke most liberally endowed the institution at Northampton, Mass., named after him; though in that country such support is the less wanted, on account of the State aid which is afforded to institutions for the deaf. Let us hope to find in this far richer country some such munificent benefactors.

Briefly to recapitulate some of the conclusions to which our investigations led us, we find that the "French" system schools, to a limited extent, will always be wanted for those who cannot be educated on the "German" system, viz., the weak in intellect, and the very few

whose speech, had they been hearing persons, would have been scarcely intelligible.

All others should be educated on the "German" system. And it should be borne in mind that it is for the poor that education on this system is so especially desirable. Important as it is to all, to the poor the gift of speech is of intense value, enabling them to make themselves understood to the world at large.—*Journal of the Society of Arts.*

DR. ASA GRAY ON DARWINISM.[1]

PROF. GRAY has, in the volume under notice, presented us with a compilation of extremely thoughtful and erudite essays, collected from the scientific periodicals in which at various times they originally appeared, as reviews of Mr. Darwin's book on the "Origin of Species" and of kindred works. The main object of the whole series is to vindicate the religious character of the evolutionist, of whose theory Prof. Gray entertains a high opinion, supporting it by several new and cogent arguments, based on his own immediate observation and researches. Darwin himself, the priest and prophet of the new theory, thus expresses his convictions: "To my mind, it accords better with what we know of the laws impressed on matter by the Creator, that the production and extinction of the past and present inhabitants of the world should have been due to secondary causes, than that each species has been independently created." It is therefore evident that Prof. Gray has not only reason, but authority on his side, when he affirms that the charge of atheism brought against the Evolutionists is a false conclusion, and that nothing hinders the most thorough-going of the school from indorsing the noble dictum of Aristotle, philosopher and naturalist—"the Divine it is which holds together all Nature."

Experience teaches us to argue from analogy, and to refer productions in the past to the same causes or sets of causes as those we see operating in the present. It is nowhere within the knowledge of living man that God acts, or has acted, on any principle of caprice, working, as Lord Bacon says: "by means of his own rules upon the creature, as fully and exactly as he could by miracle and new creation." The immediate source of the volition inherent in matter is out of our ken, we see only the effects produced by it, and to suppose that it ever acted in any other way than that in which it now acts is obviously to suppose that the earlier ages of the world were not regulated by the laws which obtain in our own, and that some radical and wholly unaccountable change has taken place in Nature and her modes of production and transmutation since the commencement of our era. Moreover, the whole tide of investigation and speculation with regard to the various departments of natural science sets in the direction of evolution; and again, arguing from analogy, we cannot be wrong in apprehending a probable synthesis and harmony of the circle of natural and physical sciences. The theory of derivative process in the origin of animal species chimes in wonderfully well with the result of M. Alphonse de Candolle's botanical investigations, an account of which was published before the appearance of Darwin's hypothesis, in the "Géographie Botanique Raisonnée." "Existing vegetation," says M. de Candolle, in the final chapter of this classical work, "must be regarded as the continuation, through many geological and geographical changes, of the anterior vegetations of the world; consequently the present distribution of species is explicable only in the light of their geographical history." Certain species or quasi-species may, in his opinion, have originated through diversification under geographical isolation, and yet others independently of such cause.

With regard to geology, Sir Charles Lyell has given us his conviction that "the natural operations now going on account for all known geological changes connecting the past with the present by imperceptible gradations," and Prof. Geikie has long since taught us that not only upon such an hypothesis can the existence, structure, and position of the sedimentary, organic, and igneous rocks of the earth be rightly explained and understood. Extending our inquiries into the domain of physics and chem-

[1] "Darwiniana: Essays and Reviews pertaining to Darwinism." By Asa Gray, Professor of Natural History in Harvard University. New York: D. Appleton & Co.

istry, we find the scientific world, with but few individual exceptions, quite content to accept the nebular hypothesis framed by Laplace, and to believe that the matter of the solar system existed originally in the form of a vast diffused revolving mass, which, gradually cooling and contracting, threw off, in obedience to mechanical laws, successive rings, from which subsequently, by the same laws, were produced the several planets, satellites, and other bodies of the system. Such a theory is indeed justly regarded as the complement and corollary of the Newtonian doctrine, which proves that certain forces acting upon matter in certain directions produce planetary orbits of the exact measure and form in which observation shows them to exist. The merest tyro in science regards light, heat, electricity, magnetism, chemical affinity, and mechanical power, as varieties or derivative and convertible forms of one force, instead of believing them independent species; and chemists have lately hinted their anticipation that some or all of the supposed elementary bodies will be found to be themselves compound and derivative, while here and there appears a man bold enough to record his conviction that all these substances will be at last reducible to one, precisely as Haeckel believes that he can trace the genesis of man and of all species to a single simple element —the protoplasmic cytode.

The true reason, no doubt, why the doctrine of evolution, as applied to animal existences, has failed to become popular, is that it involves the origin of the human race, and affects, as some suppose, the dignity of man's position as the creature distinctively soul-endowed. The scientific difficulty of this knotty point—which is the logical outcome and conclusion of the theory of development—lies in the explanation of Mr. Darwin's term, "*differentiation*." Mr. Darwin says: "In each member of the vertebrate series, the nerve-cells of the brain are the direct offshoots of those possessed by the common progenitor of the whole group. It thus becomes intelligible that the brain and mental faculties should be capable, under similar conditions, of nearly the same course of development, and consequently of performing nearly the same functions." Now the brain-cells of man, as he is at present constituted, have no known analogy or representative among the lower animals. In order to fill up the gap existing between the highest extant group of the simiæ and man, Haeckel has found it necessary to invent an intermediate extinct species, to which he gives the name of "speechless apemen," assigning to them the glacial, post-glacial, and historic periods, summed up in the Anthropolithic age. The fact is, that there exists a notable hiatus in the ascending scale, for which hitherto evolutionists have failed to account satisfactorily. It is easy to silence, or at least to puzzle, lay objectors by the use of long scientific terms and phrases, but among physiologists much doubt and uncertainty exist with regard to the application of the word "differentiation," in the sense in which evolutionists are at present fond of employing it. Cells may or may not be admitted to be spontaneously generated, but it can at least be shown that each kind of cell, once in existence, has its own special endowments, and its own special method of development. One kind of cell has never been known to develop into or to perform the functions of another kind. Nerve-cells cannot, by means of any conceivable process, become cells of another sort of tissue even in the same structure; nor will the cells composing the olfactory nerve exchange office with those which constitute the optic, the auditive, or any other of its coadjutors, begotten of the same substance and on the same territory. With this truth present to the mind, it is difficult to understand how the brain-cells of the ape can ever have so altered in character and in destiny as to have "differentiated" themselves into human brain-cells. Mr. Herbert Spencer might, perhaps, wish to dispose of this difficulty, as he seeks to do with its analogue, upon the very threshold of the evolution theory, by assuming that the distance apparently separating inorganic from organic substances may be bridged over by an hypothesis relegating the dissimilarity of mode and function to a mere difference of molecular adjustment and arrangement. But if philosophy can theoretically solve the problem of life with so much ease, how comes it that chemistry remains still practically unable to demonstrate this assumed convertibility of matter? Despite all the confidence hypothetically entertained on the subject of the identity of inorganic and organic compounds, no scientific man has yet been able to construct a single particle of organizable protein, much less a vitally-endowed cell. It will be evident, on a little reflection, that the most important inference deducible from the theory of development, as expounded by the materialistic school, is one which refers all modes of being, organic and inorganic, to the operation of mere mechanical power. But if this be a true conclusion, it is hard to comprehend how that power—unconscious and characterless—should be capa-

ble of giving rise to various forms, seeing that the effects of mere mechanism, uninfluenced by volition, cannot be other than unique. How comes it that chemical ingredients, controlled by one and the same force, and unsolicited by any extraneous or inherent will, should assume so many kaleidoscopic forms as those which go to make up the actual Cosmos? Is there no hand to move the instrument, no power to shake the many-colored molecules into the varied patterns they are seen to assume? The theist, or even the pantheist, has at least an intelligible reply to offer; but what is the position of the materialist, who denies the existence of any other force than that of a blind and invariable mechanism, operating upon matter alike in all modes of being, uninfluenced by external intellect and without internal consciousness, a force which he can physically dissipate, a matter which he can chemically dissolve and evaporate? Until some answer is given to this question, we cannot accept the idea presented to us under the term *differentiation* as a definite and comprehensible one; nor can we hold that the atheistic school has advanced one step toward the elucidation of the difficulty it has so boldly set itself to explain, since Prof. Huxley wrote these words: "The question of questions for mankind, the problem which underlies all others, and is more deeply interesting than any other, is the ascertainment of the place which man occupies in Nature, and of his relations to the universe of things. Whence our race has come, what are the limits of our power over Nature and of Nature's power over us, to what goal we are tending, are the problems which present themselves anew and with undiminished interest to every man born into the world."

It is not, then, against the facts involved in Mr. Darwin's theory that we contend, but against the interpretation given to those facts by the materialistic school. The hypothesis of evolution is favored by discovery, by inductive reason, and by analogy; the puzzle lies only in the method assigned to it by modern science. We think, with Prof. Gray, that the belief in a gradual evolution extending upward from the lowest forms is, in the main, scientifically sound, and experimentally probable, but that, in accepting the issues of such a doctrine, we must carefully guard ourselves against the common error of insufficient thought, which leads certain evolutionists to ignore the prime and moving principle of the theory to which they give their adhesion, viz., that secret of the potency of matter which alone explains Prof. Tyndall's "mystery of causation."

—*Spectator.*

Meteorological Observations with Unattended Balloons.—An original and ingenious mode of making meteorological observations has lately been put in practice in Paris, by M. Sécretan, who, since the beginning of February, has been sending up every day at noon small exploring balloons, for the purpose of ascertaining the direction of the air-currents and the height of the clouds. The balloons, furnished gratuitously by the Grand Magasin du Louvre, are made of India-rubber, and filled with pure hydrogen, and are about three feet in diameter. The average velocity of elevation, as obtained from numerous experiments, is four metres (about thirteen feet) per second. Counting the seconds from the moment of starting, until the balloon disappears in the clouds, and multiplying the number of seconds thus obtained by four, gives the height of the clouds, which is found to vary from 400 metres (about 1,300 feet) to 800 metres (about 2,600 feet). It is found that the higher the clouds, the better the prospect of fair weather. The direction of the air-currents for the first 100 metres of height is almost always found to be very uncertain, varying according to unknown causes; above this height two different streams of air are often observed, the lower one extending upward to 200 or 300 metres. The clouds follow the direction of the aërial stream, in which they are wholly immersed, not being placed, as has been often stated, at the plane of separation.

EXCAVATIONS IN THE ROMAN FORUM AND ON THE ESQUILINE.[1]

By GASTON BOISSIER.

EVERYTHING invites the visitor at Rome nowadays to concern himself by preference with antiquity: antiquity it is that appears to have derived greatest profit so far from the events of the year 1870. The new Government owed much to ancient memories; to prove that Rome deserved to be free and to control its own fortunes, and that Italy had the right to claim Rome as its capital, appeal was made to the history of the republic and the empire; people were ever talking of the Senate, the Forum, the Capitol, and the new reclamations had much force added to them from being backed by these great names. Thus the Italian Government contracted an obligation to the past which it set itself about discharging so soon as it was installed at Rome. As early as November 8, 1870, by a decree of the king's lieutenant, there was instituted a superintendency of excavations for the city and the province, and Pietro Rosa, the explorer of the Palatine, was appointed to fill this office. Eight days later work was begun in the Forum. At the same time men were set to excavating at the Baths of Caracalla, the Farnese Gardens, Hadrian's Villa, and at Ostia. There was an ardor of curiosity, a passion for exploration, the like of which had not been seen for a long time, and which were repaid by the most brilliant discoveries. Unfortunately, these efforts grew slack after a few years. The bad state of the Italian finances compelled the Government to be less liberal than was to have been wished; then, too, it happened that the archæologists, *genus irritabile*, did not agree very well among themselves, and time that might have been better employed, was lost in disputes. Some few errors committed in exploring the ancient floor of the Coliseo, gave rise to sharp objections; public opinion was excited, and the Government, after having consulted a municipal commission consisting of the most eminent archæologists of Rome, as De Rossi, Visconti, Lanciani, and others, to whom had been added for that special occasion a few foreign scholars, as Henzen and Gregorovius, decided to suspend the work. Then it was that the late Minister of Public Instruction, Bonghi, in order to put a stop to these wranglings, and to give greater unity to the explorations, decided to establish a general directorship of excavations and antiquities for the entire kingdom, and to appoint thereto Signore Fiorelli.

Notwithstanding these few misadventures of detail, we can affirm that the excavations undertaken at Rome since 1870 have produced the best of results. Their success is explained by the fact that they have been carried on methodically and scientifically. Till our own times this was a very rare merit. There have been, it is true, very able archæologists before our time, yet archæology dates from yesterday. The princes who since the Renaissance have had excavations made in the soil of ancient cities, have sought only for statues, curiosities, objects of art to adorn their palaces; beyond this they took little interest in excavations. If by good luck they came upon some grand edifice underground, they hastened to remove out of it everything that could be carried away, as the paintings on the ceilings, the mosaics of the pavements, the marbles of the walls. They first gutted the buildings, and then made haste to cover up the ruins. We must therefore tone down considerably the eulogies that have been pronounced upon these pretended lovers of antiquity: they have saved less than they have destroyed, and it were difficult to say at what cost of irreparable ruins those museums were formed which have reflected so much glory on their founders. There is all the more reason for protesting against such barbarous proceedings, inasmuch as they are not yet quite out of vogue. At Rome it is stated that they are still practised daily in the excavations at Porto, and that all that is done there is to collect everything that may enrich the large collections of a great seigneur. It is openly charged that the workmen, having found the ruins of a magnificent palace, the entire structure was wrecked, and the ruins covered up, without permitting even the plan to be determined. No doubt statues, paintings, mosaics, are very valuable; but if we are curious about the different kinds of works of art found in ancient monuments, ought we not to be still more curious about these monuments themselves, which these

[1] Translated from the *Revue des Deux Mondes*, by J. Fitzgerald, A. M.

art-objects were designed to embellish, and of which the latter were after all only accessories? Even when all that remains is only the foundation and the first few courses of the masonry, what memories do these ruins awaken! What precious lessons do they teach us! What a delight for the mind to reconstruct the edifice, to restore all its ornaments with the faded paintings, the columns, the bits of mosaic which remain, to see it again in imagination as it was when at its best! In the popular quarters even, where we find fewer objects of value, what services may we do to history by collecting whatever concerns common life, by making out the plans of the houses, the directions of the streets, the sites of public squares in which so many important events have taken place—in a word, by reconstructing the topography of ancient Rome!

If this be the object sought in excavations, then we can affirm that at Rome, however well or ill the works are conducted, they will never be sterile. Wherever the laborer strikes with his mattock, he finds beneath the soil, as it is, the remains of the ancient city. Under the present houses, sleep several buried cities, and the modern monuments rise on the top of two or three tiers of ruins. Every one knows what took place in the excavations made a few years ago at the church of St. Clement, but it will be well to recall it here to show the good luck that attends excavations at Rome. St. Clement's is a fine basilica of the twelfth century, and contains some beautiful frescoes by Masaccio. While certain works were in progress, it happened that beneath the present basilica there was discovered a church older still, with curious paintings, and marble and granite columns; it dated from the time of Constantine, and had been used for seven centuries, until the sack of Rome by Robert Guiscard. Encouraged by this success, the managers of the works excavated still deeper, and soon they found, under this primitive church, a sanctuary of Mithra, and some remains of a Roman house belonging to the early period of the empire. Descending still deeper, they discovered constructions in tufa which certainly are as old as the early years of the republic, and perhaps even date from the time of the kings. Here, then, is a succession of monuments belonging to all the epochs of Roman history, from the founding of the city down to the Renaissance. Nor is this case altogether exceptional; it would not be, in my opinion, rash to expect that what has occurred at St. Clement's will occur again and again; and for this reason: Rome, like all great capitals, has been oftentimes rebuilt in the course of its protracted existence, but the Roman mode of renovating and rejuvenating their city is less disastrous than ours to the old ruins of the past. Nowadays old buildings are torn down; formerly they used to be covered over. Our aim is, above all, to have straight avenues, and, in order to facilitate the circulation of the innumerable vehicles that traverse our streets, we level away all elevations of the ground. Hence we may say that the soil of Paris is sinking from day to day, while that of Rome was ever rising. Wealthy Romans, when they desired to feast their eyes on an extended prospect, or when they wished merely to enjoy a purer air in that unwholesome climate, were wont to build their houses upon enormous substructures. So, too, when a new quarter was to be built, they began by filling up the old one with earth, and then built upon this. Hence it is pretty certain that, if we remove this earth, we shall find the original soil and the remains of the ancient buildings.

But will it be possible amid these ruins for one to know where he is? This is an important point. It is plain that history can gain nothing from these heaps of rubbish, these foundations of houses, these pavements of temples or of streets, unless we can say to what quarter of the city they belonged, or of what group of monuments they formed a part. Can we seriously expect to be able to do this? Skeptics have strong doubts; they even go so far as to ridicule the archæologists who assume to be ignorant of nothing, and who have no hesitation in giving names to the most unimportant ruins they find. Still, I think the archæologists are in the right. There is abundance of information about ancient Rome: the orators and historians are full of details regarding the localities in which the events occurred which they record. The poets, especially those of them who, like Horace, have been pleased to acquaint us with the history of their lives, frequently take occasion to speak of the quarters where they loved to dwell. What they have to say of these various quarters, and of the monuments they contained, gives many a valuable hint to us; but there exists still more trustworthy means of information. Nowadays, when a traveler would make his way up and down through the streets of a strange town, he uses a map and a guide-book; the ancient Romans, too, had their maps and guides for the traveler. A people so inquisitive and so practical, who were obliged to travel all over the world, and who in

order to govern must needs have been familiar with its geography, could not be ignorant of the value of maps; they made constant use of them, and even employed them in decorating their public buildings. They would paint maps, or trace them with the chisel on the walls of temples, or beneath the beautiful porticoes which served as promenades for people of leisure. Among these maps, plans of Rome, it is supposed, were not wanting. One of these has been found, of colossal proportions, dating from the time of Septimius Severus. It was engraved on slabs of Luna marble, which were made fast to the wall by iron clamps; in its perfect state this map must have covered a surface of three hundred square metres. What is left of it has been carefully collected and fastened to the wall of the staircase in the Capitol. On studying this map, we may get some idea of what Rome was in the second century. The streets appear to be narrow and irregular, though they had been greatly widened and straightened after the great fire in Nero's reign. The theatres, baths, basilicas, all the public monuments, are here shown in their proper places, and oftentimes they are named; the private houses, even, seem to be represented exactly as they were, and the artist has even portrayed the porticoes which often adorned their frontage on the streets for the benefit of promenaders.

I need not dwell on the value of this plan to those who study the topography of Rome. The travelers' guides are no less useful. Such "guides" there undoubtedly were, and not few in number, in a city to which people flocked from every part of the world. Such works of this class as have come down to us, all date from toward the fall of the empire; they are mostly itineraries, such as are found in our present guide-books. The traveler has his route marked out for him from one end of the empire to the other, and the names of all the edifices which he will meet on the way are given. The older editions of these itineraries are dry and curt, but the later ones are filled with marvelous stories, intended to give the reader an interest in the curiosities brought under his notice. After the lapse of twelve or fifteen hundred years, they may now render us the same service which they rendered to the travelers in the time of the Lower Empire or during the middle ages: they aid us in finding our way through this labyrinth of tortuous streets, and amid these oftentimes undistinguishable ruins of monuments. With the aid of these diverse resources—passages from ancient authors, maps, and guide-books—the topography of ancient Rome can be easily reconstructed, and there is no longer any reason to fear that excavations can lead only to finding insoluble enigmas.

There is nothing that more clearly proves the truth of this last remark, nothing that is better calculated to encourage archæologists in their hopes and in their efforts, than the discoveries made on the Esquiline within the last few years. The success of these excavations is all the more noteworthy, inasmuch as the enterprise was not at all of a scientific character. The question was simply the building of a new quarter; but at Rome it is impossible to disturb the soil, to excavate to any depth for the foundations of a house, without coming upon something of interest to the antiquarian. This was the case here, and Science has profited by works undertaken without any reference to science.[1]

Still, the Esquiline is not one of those hills which are most famous in the history of Rome. Toward the end of the republic it was an uninhabited spot of evil repute. Capital executions usually took place here, freemen being beheaded on a block, and slaves hanged from a gibbet or crucified. The bodies of these malefactors, when no one claimed them, were allowed to remain till they were devoured by birds of prey; hence the vultures of the Esquiline bore a sinister reputation at Rome. The hill was used as a burying-place for the city's poor; here, among the wretched tombs, were to be seen those famous *puticuli*, or pits, a sort of public graves, into which were cast the dead bodies of those who did not leave money enough to defray the expense of burial. Mæcenas, who saw with regret one of the most healthful quarters of Rome lying uninhabited, resolved to introduce life there. He

[1] It must, however, be said, to the honor of the industrial company that built the new quarter, that it has also had excavation made at its own expense by a distinguished archæologist, Signore Brizio, and has published the results in a work entitled "Pitture e Sepolcri scoperti sull' Esquilino" (Roma, 1876). Signore Brizio has unearthed some ancient tombs found in the vicinity of the company's works. One of these tombs contained some very curious paintings, representing the founding of Lavinium, and the death of Æneas and of King Latinus. As these paintings, in Signore Brizio's opinion, antedate the age of Augustus, they have the advantage of acquainting us with the state of those legends as they were found by Virgil when he made them the groundwork of his poem. Signore Brizio has also discovered a highly-important *columbarium* of the family of the Statilii Tauri, who were prominent during the first century of the empire. The inscriptions of this tomb furnish us with some very interesting information on the organization of slavery in ancient households.

purchased at a low price the untenanted lands, and planted magnificent gardens — the Horti Mæceniani, so famous in antiquity—and in the middle of the gardens built him a palace. This charming mansion, which commanded a view of the entire plain, was so famed for its salubrity that the Emperor Augustus took up his abode there whenever he was ill. The ancient hill, hitherto shunned by all, was now soon covered with noble mansions, and the poet Horace took pleasure in celebrating in verse the metamorphosis wrought by his illustrious friend.

It is not surprising, then, that remains of sepulchres should be found in a spot which was so long used as a burying-place. In digging for the foundations of new houses, the pickaxe would every moment hit upon bones or tombs. Among these tombs, some of which were interesting on account of the inscriptions they bore or the objects of art they contained, it was not difficult to recognize the *puticuli*. These were small, rectangular chambers, excavated down to the rock, with thick, rude walls. They were ranged in a line, but without intercommunication; hence they opened only above. When a slave had been unable to save money enough to buy a place in a poor *columbarium*, or if he had neglected to become a member of a burial society, his body was thrown into one of these *puticuli*. These chambers are still found filled with dust, bones, and human remains, which have blackened the soil and the walls in the process of decomposition.

While the work of clearing these chambers out was going on, a quite unexpected discovery was made. Inasmuch as the natural rock formed the floor of the *puticuli*, it was natural to expect that nothing would be found beneath. But it was noticed that in some places the rock itself had been excavated, and that sepulchral chambers had been hollowed out in it. Not only are these sepulchres anterior to the *puticuli* overlying them, but, from certain indications which exist, it has been supposed that they even antedate the wall of Servius, which belongs to the time of the kings. The people who hollowed out these sepulchres, therefore, lived in the time of the kings, and only a few years after the founding of Rome, and hence they possess a very high degree of interest for the historian. Alongside of the graves have been found remains of rude pottery, vases, cups, lamps; and all of these objects appear to be of Etruscan workmanship. The walls, too, are built of large, square stones, exactly the same as are seen in the walls surrounding ancient Tuscan cities. Have we not here a fresh proof of the relations existing between Etruria and Rome in those ancient times, and an argument against Mommsen, who will not admit that the Romans borrowed from any other people but the Latins and the Greeks?

It was upon these two tiers of tombs — the one contemporaneous with the earliest period of Rome, and the other dating from republican times—that Mæcenas laid out his gardens. He had carried thither all sorts of rubbish from the burned quarter, and to this he added a quantity of loam, and so he covered over with five metres of *débris* all these ancient burying-places of slaves. He then built his palace, surrounding it, doubtless, with thermæ, stadia, exedræ, porticoes—in short, with all those different structures with which the ancients were wont to embellish their residences. These have all in their turn disappeared under the soil of the modern city, and, as they have perished little by little, it might be supposed that they would have left no trace behind. Nevertheless, an important discovery, the most curious, perhaps, of all that have been made on the Esquiline, enables us to form an idea of what these surroundings of Mæcenas's palace must have been.

In March, 1874, while digging for the foundations of a house, the workmen, just below the surface of the soil, came upon the summit of an ancient wall of curved form, on which were still to be seen some traces of painting. The earth was removed with the utmost care, and then it was found that this wall belonged to a great hall still in a good state of preservation, which measured twenty-four metres in length by ten metres in width. This hall must have been decorated with considerable magnificence: on the floor were still to be seen some traces of a marble pavement, and the vaulted roof rested on a stucco cornice. The walls, on being exposed to the light, were seen to be colored with a fine bright red. At the two extremities along the cornice and near the floor they are framed as it were in two casings with a black ground, which serve as a border, and on which are painted, by skillful hands, mythological subjects grave or gay, genii and nymphs, pleasant landscapes, many of them still preserving their original freshness of color. Along the whole length of the walls, at intervals, are large niches resembling walled-up windows; in these niches, too, are some very fine paintings. Here we see standing out from a background of azure sky masses of verdure, flowers, and trees, with birds flying through the air or perched on the branches. These frescoes, in the opinion of

connoisseurs, give evidence of higher art and more skillful execution than are to be found in the best specimens from Pompeii. We know as a fact that, in the reign of Augustus, that is to say, at the time when this hall was built, a certain artist won a great reputation by being the first who thought of adorning with pleasing pictures the walls of apartments. "On the walls," writes Pliny, "he represented country-houses, porticoes, shrubbery trimmed in various figures, woods, groves, hill-sides, fish-ponds, canals, rivers. He introduced into these scenes persons walking about, or boating, or arriving at the house on asses or in vehicles; or, again, fishing, hunting, setting snares, engaged in the work of the vintage." This famous artist must surely have been employed by Mæcenas, and who knows but that here we find one of his great works? There is one circumstance which at first seemed strange, but which, as we shall see, is easily accounted for, namely, the fact that this hall, with its grand decorations, appears to be nothing but a kind of cave. It rises only four metres above the ground, while its floor is ten metres below the surface. It was lighted through its vaulted roof, and the large quantity of broken glass found among the rubbish shows that light was admitted through glass windows.

For what purpose can this vast hall have been used, and why was it constructed with so much luxury? The answer is to be found in its internal arrangement. At one end it forms a semicircle around which are seven rows of concentric seats, rising one above the other to the ceiling, amphitheatre-fashion. At the opposite end there are found, in the middle of the wall, the remains of a rostrum. These two discoveries set all doubts at rest; for, as we learn from the writers of that period, this was the arrangement common in halls for public reading where those literary gatherings, so fashionable under the empire, used to be held. Here, then, it was that the wits of the time, after inviting their friends and acquaintances to come and hear them, used to read their literary productions. Yonder, on that elevated platform, the orator would take his stand, "clad in a brand-new toga," says Persius, "with glittering rings on his fingers, after having greeted the audience with a winning glance of his eye." At the foot of the rostrum roomy seats were arranged on the marble pavement for eminent personages whom the author wished to flatter, and who were made as comfortable as possible, so that they might be the more ready to admire the performance. On the benches at the farther end of the hall sat packed together the commonalty, obscure friends, clients, dependents, people that were invited to fill the house and to applaud. This was the noisy portion of the audience: the grandees in the orchestra expressed their satisfaction in hardly-audible murmurs. When we have ascertained the purpose for which this hall was built, we have no difficulty in understanding its plan and arrangement. It was half underground so as to be cooler in summer. Public readings often took place in August during the vacations of the Senate—*Augusto recitantes mense poetas*—and we know what August is at Rome. To make the audience of two hundred or three hundred souls more comfortable at the noontide hour, the hall was half subterranean; but, at the same time, to make them forget that they were in a cave, decorations of a light and cheerful character were introduced everywhere. This was especially the object of the blind windows with their false perspectives. Thus nothing was lacking that might promote in the audience a kindly disposition toward the author: friendship had already made them indulgent critics, and the luxury and comforts of the hall might easily transform this favorable disposition into enthusiasm. Imagine a delightful retreat such as this, where everything is provided that can please the eye, with a kindly audience, and a skilled reader reciting a piece that on the whole is mediocre and poorly written, but filled with clever hits, happy observations, sly allusions to the occurrences of the day, and little thrusts at the emperor and his ministers, and you will understand why the audience should burst every now and then into applause. This it is which so often led men at that time astray as to the true merits of literary compositions, and which caused them to regard as immortal masterpieces trifles that were destined never to be heard of by later generations.

If the work done on the Esquiline by private industrial enterprise has been of such value to science, what might we expect of work done under the immediate control of Science itself, and directed toward purely scientific ends? Success was here assured: the excavations were to be carried on in well-known, historic ground, which had been the scene of great events in the past. The Forum of Rome was marked out in advance as the best field for the researches of explorers, and hence the Forum first engaged the attention of Signore Rosa. Having once commenced work here, he labored on for two years without intermission.

In speaking of the excavations in the Forum

I feel entirely at ease, for I have before me an excellent work, which refreshes my memory, and leaves me hardly any occasion for referring to my note-book. This work is the production of a young architect belonging to our school in Rome, M. Ferdinand Dutert, who closely observed all the work done under the direction of Signor Rosa, noting its progress from day to day, following in the steps of the workmen, collecting and copying every little fragment of ornamentation, every trifling bit of sculpture found as the work progressed. Not only will his book inform the reader who has never seen the Forum as to its present state, and refresh the memory of those who have seen it; he has furthermore endeavored to give us an idea of the Forum as it was in ancient times.

He reconstructs ruined temples, sets up again fallen columns, erects statues on their bases again, and restores all those splendors of which hardly the ruins still remain. I know that in works of this nature there is a great deal of conjecture, but M. Dutert's restorations are commonly grounded upon indications so clear that we may regard them, on the whole, as entirely trustworthy. To his work, therefore, I confidently refer the curious reader who would know what the Forum looked like in the early days of the empire.[1]

The Forum has always enjoyed the rare good fortune of being the centre, the heart of Rome. In nearly all of our modern capitals activity and life migrate in the lapse of ages: at Paris they have passed from the left to the right bank of the Seine, and from one extremity of the city to the other. Rome has been more faithful to its ancient traditions. Ever since the time when, according to Dionysius of Halicarnassus, Romulus and Tatius, occupying the one the Palatine and the Cœlian, the other the Capitoline and the Quirinal, concluded to meet together for a discussion of their common affairs in the humid and unwholesome plain lying between the Capitoline and the Palatine, that region has never ceased to be the scene of the assemblies and deliberations of the Romans. In early times there was no other public place in the city, and it was used for all sorts of purposes. In the morning it was a market-place for the sale of provisions of all kinds, during the day it was occupied by the courts of justice, and in the evening it was a promenade. In the course of time public squares were multiplied, and there were special markets for the sale of cattle, vegetables, fish, etc. (*forum boarium*, *olitorium*, *piscatorium*); there were even markets for the sale of choice delicacies (*forum cuppedinis*). But the old Forum of Romulus always held its preëminence over them all. Even the empire, which changed everything else, did not deprive the Forum of this privilege. The emperors established round about it public squares more extensive, more regular, more sumptuous; but these were always looked on as mere annexes and dependencies of what continued to be the Roman Forum, *par excellence*. This Forum withstood the first disasters of the barbarian invasions, and outlived the capture of Rome by the Visigoths and the Vandals. After each squall the citizens set about refitting it as best they could; and even the barbarians—Theodoric, for example—took pains to repair the ruins they themselves had wrought. This ancient public square and its edifices were still in existence at the opening of the seventh century, when the Senate conceived the unfortunate idea of dedicating to the abominable tyrant Phocas that column of which Gregorovius says that "it was preserved by the Nemesis of history as a last monument of the baseness of Romans." From this time forward the process of decay went on unhindered. Each war, each invasion, overturned some ancient monument which was never again restored. The temples and the triumphal arches were now flanked with towers and crowned with battlements after the manner of strongholds; they were daily attacked during the partisan conflicts; they finally went to ruin, and their *débris* now covers the soil to the depth of some ten metres. Every century adds its share to the stratum of rubbish covering the ancient city. When, in 1536, Charles V. passed through Rome on his return from the expedition to Tunis, the pope wished to have the avenger of Christendom pass beneath the Arches of Constantine, Titus, and Severus; and, in order to make a better route for the imperial train, he had the Forum cleared of the ruins which filled it. "Over two hundred houses," says Rabelais, who was an eyewitness, "were torn down, besides three or four churches." Antiquity was covered over with this rubbish, and lost to sight. Henceforth the Forum, now become a grazing-place for cattle (*campo*

[1] "Le Forum Romain," par M. Ferd. Dutert, architecte, ancien pensionnaire de l'Académie de France à Rome. Paris: Lévy. The only fault I am disposed to find with this excellent work is, that now and then proper names are given incorrectly. Why did not the author send his proofs to some of his fellow-pupils in the Archæological School at Rome for revision? Had this been done, we should not find, for instance, the name of the triumvir Lepidus given as "Lepidius."

vaccino), assumed the appearance it wore down to the beginning of the present century. It was no longer anything but a dust-covered square, surrounded by mediocre churches, with here and there a column projecting half-way out of the soil—a melancholy, desolate spot, where one might come to meditate upon the fragility of human greatness and the vicissitudes of events. Thus is it represented by Poussin in his little painting in the Doria Gallery, and by Claude Lorrain in the landscape preserved in the Louvre.

One might suppose that these half-buried columns would have awakened the curiosity of scholars. How is it that, since the Renaissance, none of them thought of digging at the bases of these columns to discover the soil on which they rested? That soil was the soil of the Forum, and there was no room for question but that it was full of historic *débris*, yet no one thought of undertaking a work that might lead to discoveries of the highest interest. It was not until the early years of the present century, during the French occupation, that scientific researches began to be made; but they were interrupted prematurely, and gave rise to more problems than they resolved. The results were so incomplete that hot disputes arose among the archæologists. Every one gave a different name to the buildings discovered, every one had his own plan of the Forum; neither its exact limits nor its precise position was known, some thinking that it extended from the Arch of Severus to the Arch of Titus—that is, from west to east—others making it lie in the opposite direction, from St. Adrian's to St. Theodore's; and each one found in the ancient authors passages clearly confirming his own particular view. Everything was in a state of confusion, and new excavations alone could settle the disputes. But now all of these problems have been solved; thanks to the work done by Rosa, the mass of rubbish accumulated during eight or ten centuries has disappeared. Nor was this done without labor; over 120,000 cubic metres of soil has been removed, but the topography of the Forum is now settled.

We will consider in detail all these labors, enumerating the discoveries to which they have led. The starting-point was the Julian Basilica, which had been discovered by Canina, and partly unearthed by the preceding Government. This was one of Cæsar's finest monuments. As he had not the time to finish it, his nephew assumed the task; but hardly had it been completed before it was destroyed by a fire, and it had to be begun over again. Augustus took this opportunity for enlarging its plan and making it more beautiful. There still remains of this edifice the marble pavement, covering 4,500 metres of surface and raised several steps above the surrounding streets. This pavement bears the marks of the pillars which supported the roof of the basilica, and hence we can reconstruct the plan of the building with certitude. It consisted of a double row of porticoes inclosing a grand hall. These porticoes were frequented by both sexes as a promenade; they were the largest and finest of all the porticoes in Rome. The hall was used as a court of justice. It was sufficiently roomy to accommodate a tribunal of one hundred and eighty judges, with benches for the advocates and the friends of the litigants, and a large free space for sight-seers. Here it was that the most important civil suits were tried during the empire; here it was that Quintilian, Pliny the Younger, and other famous advocates, achieved their most brilliant legal victories. Above the first tier of porticoes rose a second, reached by means of a stairway, some traces of which still remain. From this upper portico the spectator could overlook the whole *plaza*. Caligula was wont thence to throw money down among the people for the pleasure of seeing them scramble for the possession of it. From this portico a view could be had of what was going on in the interior of the basilica, and even the pleadings of the advocates might be heard. Pliny tells of how, while once he was making a plea for a young lady disinherited by her father, who at the age of eighty had been captivated by an artful woman, the crowd was so great that not only the hall, but even the upper corridors, were filled with men and women who had come to listen to him.

It was a matter of great importance to ascertain precisely the site of the Julian Basilica, for, this once known, then we can fix with certainty the names of the neighboring monuments. In the Ancyra inscription the Emperor Augustus says: "I have finished the basilica commenced by my father, situate between the temple of Castor and the temple of Saturn." This fixes the identity of the two edifices between which stands the basilica erected by Cæsar. The temple of Saturn lies nearest to the Capitol; of it there still remain eight columns. The workmanship of these columns is rude enough. They must have been repaired during the later years of the empire, in the interval between two invasions, and the work was done so hastily and so carelessly that the sections of the shafts are in some instances set upside down. The other temple, situ-

ate in the vicinity of the Palatine, is the temple of Castor, called by Cicero "the most illustrious of monuments, a memorial of the entire political life of the Romans." Of this there remain three columns which have always been an object of study and admiration to artists. They appear more striking than ever, now that we can, owing to the excavation, look at them from a lower level.

These first excavations accomplished, it was found that we were in possession of one whole side of the Forum, the southern, from the Capitoline to the Palatine. Hence all that remained to be done was to push the work on toward the north side, and the remainder of the Forum was sure to be discovered. We shall first come upon a paved street skirting the monuments just named, and ascending to the Capitol. On the opposite side of this street was a sort of square covered with great slabs of travertine, and about one hundred and twenty metres in length. This square was, as it were, the centre of the Forum. It is filled, especially alongside of the street, with large blocks of stone, on which must have stood the column and statues which were so numerous in the Forum. Near the middle, a little below the column of Phocas, there is a larger heap of stones apparently belonging to the substructure on which was erected the famous colossal statue of Domitian; at all events, this must have been its site. Statius, the courtier poet, has celebrated the erection of this statue in verses in which, defying all shame and all verisimilitude, he specially commends Domitian for his gentleness, ranks him high above Cæsar, and represents the ancient republican heroes as complimenting him. As luck would have it, the poet, in the midst of these distasteful platitudes, has contrived to render us a signal benefit. In enumerating the edifices by which the statue of his hero is surrounded, naming them and indicating their sites, he gives us information of great value as tending to identify all these ruins. "Behind him," says Statius, "rises the temple of Concord; on one side of him stands the Basilica of Julius, and on the other that of Æmilius. Full in front is the monument of him who first opened for our princes the road to heaven"—viz., the temple erected in honor of Julius Cæsar after his deification. Now, it was a point of high importance to discover this temple. And, as Statius clearly points out the direction in which it was to be looked for, it was soon found on the east side of the Forum, in the open space extending from the temple of Castor to the temple of Antoninus and Faustina. Of this temple of Julius only some shapeless ruins of the substructure now remain, but that these ruins really belong to the edifice in question is proved beyond cavil. It was observed that the steps in front do not, as is usual, extend the whole length of the façade; in the middle is a wall of peperine faced with slabs of marble, dividing the two narrow stairways. This wall used to support a platform from which orators could address the people. Now, we know that Cæsar conceived the idea of erecting a new hustings facing the ancient Rostra; that Augustus adorned it with the beaks of the ships taken at Actium; and that it was situated in front of the temple which he built in honor of his uncle, on the very spot where the body of the great dictator was burned. This hustings once found, it is beyond doubt that the monument back of it can be none other than the temple of Cæsar.

The discovery of this temple enables us clearly to define the limits of the Forum. We have made out three of its sides, and the fourth alone we have not been able to unearth; it underlies a portion of new Rome, and in order to bring it to light we should have to tear down all the houses from San Lorenzo in Miranda as far as San Martino. Fortunately, we can pretty accurately determine what we should find here. The texts of ancient writers are pretty explicit with regard to this part of the Forum, and a certain very singular discovery places it so to speak under our very eyes. In the course of the excavations made near the column of Phocas, there were found two bass-reliefs, belonging apparently to the first century, but which were worked up into buildings erected during the middle ages. The subject of these bass-reliefs has given rise to much heated debate, yet every one admits that the scene is laid in the Forum, and that the artist intended to represent its principal monuments. In one of the bass-reliefs we plainly recognize the temples of Castor and of Saturn, as also the Julian Basilica, that is to say, the edifices of the south side of the Forum. Now, as the other one was designed to face this, it is certain that it contains the monuments on the opposite side of the Forum—the one side hitherto not unearthed. Thus we are in possession of the elements necessary for a knowledge of the entire Forum.

True, it is not the Forum itself that is restored to us by these excavations; we see nothing but shapeless ruins, but these assuredly awaken great memories. One cannot, without emotion, tread the pavement of the Via Sacra over which so many triumphs have passed, or step upon the broad flags worn by the feet of so

many great men. But these flags are now all cracked and broken, and the street pavement is in ruins. We may add that, in order to maintain communication between the two halves of the modern city, it has been necessary to leave in the middle of the excavations an unsightly causeway known as the "Bridge of Consolation." It cuts the Forum in two, and prevents a general view of it from any side. To see the Forum as it used to be, we must first in imagination remove this obstacle, and then—a more difficult thing to do—we must repair and reconstruct these ruins. Here, M. Dutert's reconstruction becomes of service, as aiding our imaginations in the effort to go back into the distant past.

Suppose, then, that we have before our eyes not heaps of ruins, but the Forum in its entirety and intact, just as it was when the empire began to decline, after the time of the Antonines. Let us take our stand at some convenient and central point, from which we may command a general view, for instance, on Cæsar's hustings, and contemplate the spectacle which presents itself to our gaze. I should not be surprised if the first glance were to fall short of our expectations. We are wont to reckon great size and regularity of plan among the principal qualities of a public square, and the Forum is small and irregular. Originally, indeed, the Forum included areas at different levels and with uneven surface. The *Comitium* rose out of a swampy plain; the *Vulcanal* rose above the Comitium; and from the Vulcanal a steep ascent led to the Capitol. In the course of time the construction of great edifices led to a partial concealment of these differences of level; but these edifices, built at random, and at very different periods, do not always correspond to each other. Time, it may be said, made the Forum what it was. No architect drew its plan beforehand, fixed its proportions or distributed the monuments over its surface; and hence they are huddled and crowded together without order. Each of the great personages that ruled the republic having been intent on leaving some memorial of himself in the most famous and most frequented locality in Rome, the result is a multitude of temples, basilicas, and triumphal arches, fairly bewildering. New structures were constantly building, and, when old ones were repaired, they were always increased in size. In consequence of these successive invasions of its area, the free space of the Forum grew more and more contracted. Even the spaces between these edifices which should have been left open for public use, were encumbered with trophies, *ædiculæ*, columns, and above all with statues, which, in the language of Chateaubriand, formed a population of the dead in the midst of the living population of the city. Vanity so multiplied these monuments that from time to time the Senate was compelled to have some of them removed. Among the columns were some of considerable prominence; they were surrounded by a balcony commanding a view of the whole Forum. On days when a successful and grateful candidate gave a spectacle to the people, the descendants of those in whose honor the column was erected were entitled, themselves and their families, to occupy this balcony for the purpose of viewing the performances of the gladiators or athletes. Hence, I do not doubt that on first view the Forum would have an unpleasing effect; such a crowding together of monuments wearies the mind, and one regrets the absence of all order, simplicity, and symmetry.

I nevertheless am of the opinion that, if for a moment we forget our habits of thought, our eye will adapt itself to this rather confused spectacle, and that we will find therein a certain picturesqueness that is never met with in the cold and stately regularity of our great public squares. We shall then be able without difficulty to comprehend the general plan of the Forum, though at first it appeared to have no plan. It stretched from west to east, and formed not a long quadrangle, but rather a sort of trapezium, being wider at the end toward the Capitol than at its other extremity. In the middle of the streets surrounding the Forum, there was a certain space paved with broad flagstones, and reserved for promenaders and loungers. At the extremity of this promenade toward the Capitol was the hustings of the republican period, the same from which the Gracchi and Cicero addressed the people. Its foundations are still to be seen near the Arch of Severus. The hustings erected by Cæsar stood just opposite. Supposing ourselves to stand on Cæsar's hustings, we see right in front of us the Rostra of republican times; behind this the temple of Concord, erected by Camillus; and in the background the *Tabularium*, in which were kept the archives of state. To the right the Via Sacra, entering the Forum near the temple of Antoninus and Faustina, crossed it on its north side—the side not yet explored; it skirted first the basilica of Paulus Æmilius situated in front of that of Cæsar, and which rivaled the latter structure, and then the palace of the Curia, in which the Senate met. After passing under the Arch of Severus it

turned to the left, and near the temple of Saturn began to ascend the hill-side toward the Capitol, reaching by a steep gradient the famous temple of Jupiter Capitolinus, the foundations of which have just been discovered under the Caffarelli Palace.

Topographical problems are not the only ones raised by the study of the Forum. After we know where to locate the edifices it must have contained, and what names are to be given to the ruins of monuments which still remain, all is not yet done; other questions arise that are nearly as difficult of solution. Above all, the question suggests itself, on seeing how inconsiderable its area was, how it could suffice for all the purposes which it served. We know from ancient authors that it was the most frequented place in all Rome. Loungers, so numerous in all great cities, here kept their rendezvous. Horace tells us that he used to walk about in the Forum every evening. There was much here to gratify curiosity: to say nothing of the charlatans of every sort, who were never wanting, there were now and then regular exhibitions of paintings. The *chefs-d'œuvre* of Greece, after its overthrow, were often exhibited here under the porticoes or in the temples, and amateurs flocked thither to view them. Victorious generals would sometimes have their battles painted by able artists, and exhibited in the Forum. One military commander, the Prætor Mancinus, carried his complacency so far as to take his stand beside a picture representing his great achievements, in order to give to visitors such explanations as they might require. This politeness so delighted the people that in the following year they named him consul. News-mongers and politicians crowded around the hustings, forming animated groups, who engaged in hot disputes, raising a fearful clamor. The disputants busied themselves with drafts of laws and plans of campaign, and they spared neither the unpopular statesman nor the general who was not victorious in the first battle. A little farther down, below the Curia and near the Æmilian Basilica, was the 'Change. The money-brokers had their offices in certain arched passages known as *Jani*, and here they might be seen seated at their desks, entering on their books the money placed in their keeping, or the moneys they loaned on good security and at an enormous rate of interest. Here were assembled the stewards of great estates, the *equites* who farmed the public revenues, brokers, usurers, borrowers; important business was here transacted; money was quickly made, but more quickly lost.

The Forum was also sometimes used for popular exhibitions, especially combats of gladiators. Of course on such occasions it was crowded with spectators. People were packed together in dense masses, not only in the vicinity of the arena itself, but also on the steps of the temples or the terraces of the basilicas, and all along the streets leading up the Capitoline and the Quirinal. Such exhibitions often lasted several days, and usually closed with a banquet served to all who were present. To enable the people to view the spectacle and to enjoy the banquet despite the heat of the sun, Cæsar bethought him of stretching great awnings over the entire Forum; and these awnings were of silk, according to Dion Cassius. Soon this sort of magnificence became the rule; and once even, during a very hot summer, Augustus suffered the awnings to stand during the entire season. A more frequent spectacle even than the combats of gladiators was the obsequies of great personages. The *cortége* always passed through the Forum, with its bands of flute-players, trumpeters, and clarionists, its women-mourners, its troops of friends, clients, and dependents. Finally come chariots or litters bearing the ancestral statues. When the family of the deceased was an ancient one, the number of statues carried in the funeral *cortége* was very great; at the funeral of Marcellus there were over 600 of them. And these processions never failed to pass through the Forum even when it was occupied by other assemblages of people.

But it was the political assemblies, above all, that attracted crowds to the Forum. Of these there were three kinds, known as—1. The legislative assemblies (*consilia plebis, comitia tributa*), which made laws. 2. Simple meetings (*conciones*), in which nothing was put to a vote, and which were called by magistrates who desired to make anything known to the people. 3. Political trials, conducted in public before juries, drawn by lot, and presided over by a prætor. Of these three sorts of assemblies, the first was the most important, and of least frequent occurrence. It matters not how insane the desire of perpetually changing their legislation that possesses a free people, they cannot every day have laws to make or to unmake. I would add that this first class of meetings was not the most popular of the three. Those solid discourses in which are set forth broad views, and questions of state are discussed, are less adapted to popular assemblies than to select bodies consisting of small numbers of educated men. The multitude usually take but little pleasure in such discourses, which are

too calm, too cold for them. To arouse their interest, there was needed at Rome some personal question; and hence the importance attached to the political trials. The latter were as frequent at Rome as at Athens, and politicians were constantly engaged in defending themselves, or in bringing charges against their opponents. Political parties had no other means of attack but this. It was a spectacle of high dramatic interest to see a great man surrounded by his weeping family, his clients, and his friends, standing up in the Forum to defend his fortune and his honor, and crowds would come to witness it. No less numerously attended were the meetings called by magistrates for the purpose of addressing the people. The democracy is everywhere very exacting and full of suspicion; at Rome, as elsewhere, they desired those to whom they had intrusted the public offices to render an account of their doings, and this duty no magistrate neglected to discharge who wished to continue in favor with the people. Cato, one of the most perfect types of the popular magistrate, always maintained relations with his constituency. He was ever calling meetings for the purpose of setting forth in detail what he had done; he would express his opinion on every subject with that broad humor that so pleases the multitude; he would talk about himself and others, never sparing his opponents, whom he scrupled not to describe as debauchees and knaves, while he never tired of bragging of his own sobriety of life and his disinterestedness. The people were delighted with this sort of address, which made them feel that they were the sovereigns.

In seasons of public excitement, when it was known that a tribune was about to speak against the Senate, or to discuss more all-absorbing question, artisans would quit their work, the shops would be shut, and the people flocked from all quarters to the Forum. On such occasions the Forum, being packed with people, must have appeared rather small. But the crowding was still greater at the legislative assemblies of which we spoke above. Then certain precautions had to be taken for regulating the voting: the place was divided into thirty-five separate compartments for the different tribes, and narrow passages, called bridges, were constructed, through which the citizens could pass only one by one to deposit their ballots in the baskets. When we cast our eyes over the Forum as it now is, and see what a small area it embraces, it is hard indeed to understand how it ever sufficed for all those complex operations, and how it ever could hold the Roman people assembled.

True, this place which we now see is not the Forum of the republic, but only that of the empire. We are told that it was not narrowed down to its present limited area till the time of the empire, when there was no need of a larger Forum, inasmuch as the people no longer passed upon laws; but this hypothesis is erroneous. There doubtless was a time during the early centuries of the republic when the Forum was not so filled with buildings as it now is. With the exception of a few temples which are as old as the city itself, it then contained only miserable shops, the public schools, and butchers'-stalls. But from the time when Cato built the first basilica, monuments of every kind were constantly erected. Nearly every monument that is still to be seen was built under the republic; all that the empire did was to repair them. These monuments, therefore, did not hinder the meeting of the popular assemblies in the Forum. The place was very nearly what it is now about Cæsar's time, when Clodius and Milo had their regular battles here, and when Cicero here thundered against Catiline or Antony. There is another reason for holding that the Forum could never have been so extensive as we picture it in imagination, and this is, that it must have been possible for orators to make their voices heard. Now, however strong we may suppose the lungs of a Cicero or a Demosthenes to have been, we could never think of them delivering speeches in the Place de la Concorde.

The republics of ancient times found themselves in great straits when they had to lay out their public places: they had to make them large enough to hold an entire people, and at the same time so small that the voice of the orators would not be lost. Inasmuch as the Roman Forum was for many centuries the ordinary place for holding public assemblies, we must suppose that it fulfilled these two conditions. This is a fact, and we must accept it, even though we may be unable to account for it. Hence we are forced to believe that the orators could be heard here; that, even when their words were not very distinctly heard, their voices could still control those noisy meetings which have been compared to the waves of the stormy sea. Perhaps the situation of the Forum will enable us to understand what at first appears to be absolutely unaccountable. It occupies low grounds, surrounded by steep declivities. On the side toward the Capitol there is actually a precipice; the incline is more gradual at the opposite extremity toward the Arch of Titus, but still rather steep. One "went down" to the

Forum, as the saying was. When we consider that this arrangement of the ground, the small extent of the place, these surrounding hills, these inclosing buildings, supply conditions very favorable to the voice, it becomes a little less surprising to us that orators should have made themselves heard here, and that they should have been able to produce such great effect. We must further confess that this Forum, small as it appears, may have been sufficiently large to hold all who wished to be present at important trials or to deposit their ballots on days of voting. It may be that, after all, the number of voters was less than we suppose, and that the place was large enough simply because a portion of those qualified to vote absented themselves. Toward the end of the republic, in proportion as the popular assemblies became more stormy, wise and moderate men, who everywhere are the most timid, fell into the habit of staying away. When it was seen that these assemblies usually ended in bloody quarrels, people that disliked strife ceased to attend. Cicero bitterly complains of this desertion of the Comitia, and speaks of certain laws as having been passed by a handful of citizens, or even by those who had no right at all to vote. This explains why so many Romans should have made so little difficulty about accepting the empire: it was a very small matter for them to be deprived of political rights which they themselves had renounced.

Still, under the empire, the Forum appeared to be too small. The popular assemblies were now no more; but the promenaders, loungers, sight-seers, were constantly increasing in numbers, and strangers were coming in from all parts of the world. The plan was now adopted, not of enlarging the old Forum—a thing that could not be done save by destroying the ancient monuments—but of constructing other forums all around it. Cæsar made the first step in this direction, and the other princeps imitated him. As each strove to eclipse his predecessors, the outlay was larger from reign to reign, and the buildings finer. Thus it was that there was created in the heart of the sovereign city the finest collection of monuments and public places ever seen. The stranger who entered Rome by the Flaminian Way, and who, after passing through the Forums of Trajan, Nerva, Vespasian, Augustus, and Cæsar, came at last to the ancient Forum Romanum, where the beauty of the edifices was enhanced by the grandeur of the memories associated with them, must have been filled with surprise at the spectacle. However great an idea he had conceived in his own country of the wonders of Rome, he had to confess that his dreams fell below the reality. He felt that he stood in the capital city of the whole world, and he went home filled with an admiration, never to be effaced, for that city upon which were fixed the eyes of all mankind, and which, as early as the second century, was called the "Holy City."

A LEAF OF EASTERN HISTORY.

By the Late NASSAU W. SENIOR.

INTRODUCTORY NOTE.—In the month of June, 1855, M. Ferdinand de Lesseps visited England for the purpose of inducing the British Government to withdraw their opposition to the proposed construction of the Suez Canal. He had been for some years the French consul-general in Cairo. His father had filled that post before, and it was mainly by the advice of the elder M. de Lesseps that the sultan selected Mehemet Ali to be Pasha of Egypt.

Mehemet Ali reposed great confidence in M. Ferdinand de Lesseps, and intrusted to him in a great degree the education of his favorite son Saïd Pasha, who consequently was prepared to view with favor M. de Lesseps's important scheme. A firman was submitted to the sultan, who, however, delayed its ratification until the formal consent of England could be obtained, and M. de Lesseps was empowered by the French Government to negotiate with the members of the British cabinet. M. Thiers gave him a letter to Mr. Senior, in whose house he became a frequent and a welcome guest.

A commission, consisting chiefly of engineers from various countries, was appointed to proceed to Egypt in the following winter, and Mr. Senior (who, unlike most of his countrymen, had believed from the first that the proposed canal

would rather forward than impede the interests of England) was invited, with three or four other personal friends of M. de Lesseps, to join the party. They were royally entertained by the viceroy. The best apartments in the best hotels were put everywhere at their disposal; carriages, camels, and running footmen, were always in readiness for them, and a small steamer conveyed the whole party up the Nile. According to his practice when abroad, Mr. Senior kept an elaborate journal, which still retains its interest, for the East does not materially change. This journal contains records of his conversations with people of all nations: a fact well known, for on one page he writes: "The viceroy said to Ruyssenaer after I left him, 'J'ai donné à M. Senior une belle page pour son journal.'" Among his interlocutors there was none more interesting and instructive than Hekekyan Bey, an Armenian, who had in early youth been sent by Mehemet Ali to be educated in Europe. Throughout the reign of that pasha he and his family had retained great influence: his brother-in-law Kosrew Bey being first dragoman, another brother-in-law, Artim Bey, prime-minister, and Hekekyan himself director of the École des Arts et Métiers. Abbas, the next pasha, hated his grandfather's friends, and dismissed them all. In 1855 they were still out of office.

In 1862 Hekekyan Bey came to England with his wife and his son to see the second Exhibition. He was at that time an exceedingly handsome man, apparently about fifty, tall, and rather like an Italian from the north of Italy. He was full of animation and good-nature, and his manners and conversation were most agreeable. He spoke both French and English perfectly well. His wife spoke nothing but Arabic, so it was difficult to get on with her. On one occasion she put on, as a favor, her Eastern dress. It was composed of black satin, and, it must be owned, was far from becoming to an elderly lady; but those were the days of crinoline—in 1877 it would probably not appear so extraordinary.

It is difficult to make selections when there is so much that is interesting and instructive. This story of Mehemet Ali, related by Hekekyan, is perhaps the most striking of the following extracts.

Extract from Mr. Senior's Journal.

"Mr. and Mrs. Lieder, Hekekyan Bey and his wife, and Mr. Bruce, drank tea with us.

"It is a remarkable indication of Oriental morals that of our four Egyptian guests, two, Mrs. Lieder and Hekekyan, believed themselves to have drunk poisoned coffee. In each case it was detected by its peculiar and extreme bitterness, and not enough taken to do serious mischief. Mrs. Lieder received hers at Nazleh Hanem's; Hekekyan's was given to him at Meneele Pasha's. It was in 1840. He was at that time out of favor with Mehemet Ali: his boldness of conversation and perhaps his boldness of character, partly natural and partly acquired in England, unfit him for Eastern courts. He has seldom continued long in favor or long in disgrace. His talents, knowledge, and industry, force him into employment, and some unguarded speech or the performance of some duty offensive to the master, or to his minister, or to his cook, or to his barber, turns him out: when they cannot do without him he is recalled.

"'In 1840,' he said to us, 'after the bombardment of Acre, some weeks passed without any news from Ibrahim Pasha, or from his army in Syria. A strong suspicion arose that he had made his peace with the sultan at his father's expense, and that Mehemet Ali's reign and life were drawing to a close.

"'I was then the engineer charged with the defenses of the coast. We were expecting an attack from Sir Charles Napier, and I had been to Rosetta to inspect the batteries. It was on a tempestuous night that I returned to Alexandria, and went to the palace on the shore of the former island of Pharos to make my report to Mehemet Ali.

"'The halls and passages which I used to find full of Mamelukes and officers, strutting about in the fullness of their contempt for a Christian, were empty; without encountering a single attendant, I reached his room overlooking the sea; it was dimly lighted by a few candles of bad Egyptian wax, with enormous untrimmed wicks. Here, at the end of his divan, I found him rolled up in a sort of ball, solitary, motionless, apparently absorbed in thought. The waves were breaking heavily on the mole, and I expected every instant the casements to be blown in. The roar of wind and sea was almost awful, but he did not seem conscious of it.

"'I stood before him silent. Suddenly he said, as if speaking to himself, "I think I can trust Ibrahim." Again he was silent for some time, and then desired me to fetch Motus Bey, his admiral. I found him and brought him to the viceroy. Neither of them spoke, until the viceroy, after looking at him steadily for some minutes, said to me: "He is drunk; take him

away." I did so; and so ended my visit, without making any report.'

"'Was Motus drunk?' I asked.

"'He was drunk,' answered Hekekyan, 'as all the naval officers were; they expected to be sent out to fight Napier, and kept drinking to keep up their spirits.

"'The viceroy,' he added, 'was not pleased at my having witnessed his emotion or his neglected state; but what completed my disgrace was my having alluded some months after to the events of that night. He immediately sent me off to Cairo, on a trifling errand about the fortifications of the citadel, and kept me there for three months.

"'At the end of that time I received a summons from Meneele Pasha, the man who has just returned from Eupatoria, who was the Minister of War. He placed me by him on his divan and gave me a pipe, but said nothing. Then came coffee. I just sipped mine, and found it totally unlike anything that I had ever tasted before; it was nauseous and intensely bitter. I gave it back to the servant. Meneele looked hard at me, but said nothing. I sat a few minutes longer, waiting for him to tell me why he had sent for me, and, hearing nothing, went away, without a word having passed between us. Half an hour after Mehemet Ali arrived from Alexandria at the citadel.

"'I cannot but suspect that I had become disagreeable, and that he had directed Meneele to dispose of me before his return to Cairo. It certainly seemed that the only purpose for which Meneele summoned me was that I might drink that cup of coffee.'

"'But,' I said, 'if Mehemet Ali wished to remove you, might he not have had recourse to a more certain expedient?'

"'There were objections,' answered Hekekyan, 'in my case to the use of the dagger or the cord. I was not then, as I am now, alone; one of my brothers-in-law was his prime-minister, another was his first interpreter. It would have been inconvenient to part with them, and they certainly would have quitted him.

"'He wished me to die, but he did not wish to be suspected of having killed me. I believe that it was for the same purpose that he sent me a few months after, at the beginning of the hot season, to pass some months in the Southern Desert; and I am not sure that he did not take means to increase the dangers of the desert. The only place at which I halted was Berenice, on the Red Sea, where I spent a month, time enough for my sojourn there to be known at Cairo. A few days after I had left Berenice a party of armed Bishareem arrived there, inquired anxiously for me, and, finding that I was gone, followed me; luckily I left Komsko on the Nile before them, and in my boat I was safe, for the Bishareem are not aquatic.'

"'Are they coarse or scientific poisoners,' I asked, 'in Egypt?'

"'Scientific,' answered Lieder. 'The poisons are vegetable, and are not often intended to produce an immediate result, or even to operate by a single dose; they undermine the health by frequent repetition. The custom of giving coffee to every visitor affords great facilities to what may be called dietetic poisoning. In Europe, unless you live in the same house with a man, it is difficult to poison him unless he dines with you, and even then, without accomplices. The accomplices cannot be easily obtained, and they would possess a dangerous secret, which would make them your masters. You seldom can repeat the dose, it must therefore be violent. The fact of his having dined with you would be easily proved, and his death by poison connected with it. The poisonings of Europe, therefore, are family poisonings.

"'In Egypt a man may drink coffee in the course of the morning at ten different houses. A single accomplice is all that is necessary; there is no difficulty in prevailing on him to accept the office; it is as natural to him as any other service. He does not think much about it, and is not likely to talk about it. If he does, you poison him, or have him strangled, and bury him in your garden. You run little risk by doing so; nothing that happens in a man's house is known. For most purposes, indeed for all purposes, except opposing the will of the pasha, a man's house is his castle in Egypt more really than it is in England. The reverence paid to the harem extends to everything that is under the same roof. The Egyptian thinks himself well recompensed for being a slave abroad by being absolute at home. He would not accept freedom or security for himself if the condition were that it should extend to his household.'

"'In this country,' said Hekekyan, 'the disappearance of an unprotected man is not noticed. If I were to walk out to-morrow and not to return, no one except Madame Hekekyan would think about it. She would be alarmed the first night, and more so the second, and on the third she would give me up for lost. But she would infer that I had been removed by the higher pow-

ers, and that, if she made complaints or even inquiries, she would share my fate; and in a short time it would be forgotten, at least among the Turks, that Hekekyan Bey had ever existed.

"'Mr. Lieder,' he added, 'says truly that our poisonings are seldom rapid. When the existence of a man has become offensive to the master he is impoverished, his villages are resumed, claims against him are countenanced, it is whispered about that it is imprudent to visit him or to receive him; he soon finds himself alone as if he were in the desert. A Mussulman who has no resources, who neither sports, nor gambles, nor converses, nor reads, nor writes, nor walks, nor rides, nor travels, soon smokes himself into dyspepsia. If he be, what few Mussulmans are, a man of quick sensibility and self-respect, he is also oppressed and irritated by the intolerable feeling of wrong. Then perhaps he is suddenly recalled. He is again in favor, he is soon to be again in power; at every visit that he pays to the palace or to one of the divans, he gets a cup of coffee slightly impregnated; the moral and the physical excitement combine. His death follows an illness which has not been scandalously short.'

"'The remark,' said Lieder, 'that Orientals are not to be judged according to European notions, is so obvious that it has become trite; on no point is the difference between the two minds more striking than in the respect for life.'

"The European cares nothing for brute life; he destroys the lower animals without scruple whenever it suits his convenience, his pleasure, or his caprice; he shoots his favorite horse and his favorite dog as soon as they become too old for service.

"The Mussulman preserves the lives of the lower animals solicitously. Though he considers the dog impure, and never makes a friend of him, he thinks it sinful to kill him, and allows the neighborhood and even the streets of his town to be infested by packs of masterless dogs whom we should get rid of in London or Berlin in one day. The beggar does not venture to destroy his vermin, he puts them tenderly on the ground. There are hospitals in Cairo for superannuated cats, where they are fed at the public expense. But to human life he is utterly indifferent: he extinguishes it with much less scruple than that with which we shoot a horse past his work.

"'Abbas,' said Hekekyan, 'when a boy, had his pastry-cook bastinadoed to death. Mehemet Ali mildly reproved him for it, as we should correct a child for killing a butterfly; he explained to his little grandson that such things ought not to be done without a motive.'

"'When Nazleh Hanem,' I asked, 'burnt her slave to death for giving her cold coffee, did her father interfere?'

"'No,' said Hekekyan, 'he could not. That took place in a harem. The murdering the messenger at Shoobra is another instance: it would have cost little to shut up the poor old man until any danger of his telling from whom he came was over; but it was simpler to drown him. Perhaps, however, in that case Mehemet Ali merely followed instructions which he might have thought it dishonorable to disobey. There was probably at the bottom of the letter some mark indicating how the person who brought it was to be disposed of, as we write, "Burn this note as soon as you have read it."'

"'That incident,' I said, 'is mentioned by Cadoleone and Barrault in their history of the East in 1839 and 1840, and they affirm that the messenger was drowned for having refused to disclose the name of his employer.'

"'That is a mistake,' said Hekekyan. 'I was the only person present when Mehemet Ali received the messenger. He was obviously a man of the lowest class, who would not have refused to disclose anything. Mehemet Ali asked no questions, and indeed had none to ask.'"

Mr. Senior heard the sequel to this story some time afterward at Alexandria from Artim Bey, Mehemet Ali's prime-minister:

"I asked him if he recollected the night described to me by Hekekyan when Mehemet Ali lay alone in an empty palace, thinking over the chances of Ibrahim's fidelity.

"'Certainly I do,' he answered, 'and I recollect the day that followed it. Napier appeared off the old port and sent in a letter requiring the viceroy to surrender the Turkish fleet, and to submit to the award of the four powers.'

"'What was his force?' I asked.

"'I forget,' answered Artim; 'five or six ships. We had about eighteen sail-of-the-line and twenty frigates—not less than fifty ships—but we could not rely on the Turkish sailors. They would have joined the English if we had allowed the ships to quit the port, nor could we indeed trust the Egyptians, and as for the artillerymen they had spiked the guns on the batteries. Mehemet Ali was still in his mood of resistance. I took to him Napier's letter. He asked fiercely, "What does the Englishman

say?" "Let the letter be translated to you," I answered. This was done. He rose from his divan and began to walk up and down the room exclaiming: "I will not give up the fleet; they may burn it if they can, they may burn Alexandria, they may drive me out of Egypt and I will live a *hadji* in Mecca; but they shall not drive me out of Egypt, or even out of Alexandria. I will fight until further resistance is impossible. I will make my last stand in the powder-magazine, and when all is lost, *je sauterai*." "This may be well," I said, "in your highness's high position, but it will not suit your subjects. *Si vous sautez, vous sauterez seul.*"

"'He came up to me in a fury, and I own that I trembled, and that my knees shook. I moved back, and he advanced until I was close to the wall. Then we stood face to face. He looked at me for some time, probably considering whether he should give a sign for my being strangled. At last he said, "Send an order to the Englishman to come on shore to me."

"'I wrote to Napier to say that "the viceroy thought that the matter could be best arranged in a personal interview, and to request that he would visit his highness at the palace." The next day Napier came. Mehemet Ali had had a night to reflect, and he had profited by it. He seized him by both hands, placed him on his right side on the corner of the divan, gave him diamond-topped pipes, and coffee in gold cups, and acceded without remonstrance to all his demands, and in the same evening Napier was wandering alone over the bazaars of Alexandria in a round hat. I offered him a "tchaous," but he said he had objects with which an attendant would interfere.

"'Mehemet Ali,' he continued, 'was not a safe master, but he was an agreeable one. He was very generous; he had a quick and correct appreciation of character, and his conversation was charming.

"'Although he did not learn to read until he was forty-seven, he had more literary taste than any Turk that I have known. He had every book about Napoleon that he could find translated for him, and read them or had them read to him with avidity. He made me translate the "Esprit des Lois," and read it with great interest. Of course I rather paraphrased than translated. He would not have understood Montesquieu's terse epigrams.

"'He told me one day that he had read much about Machiavelli's "Principe," and begged me to translate it for him. I set to work, and gave him the first day ten pages, and the next ten pages more, and ten more the third; but on the fourth he stopped me. "I have read," he said, "all that you have given me of Machiavelli. I did not find much that was new in your first ten pages, but I hoped that it might improve; but the next ten were not better, and the last are mere commonplace. I see that I have nothing to learn from Machiavelli. I know many more tricks than he knew; you need not translate any more of him."

"'Though passionate, he was not cruel, nor indifferent to human suffering. I went with him one day to one of his farms. He found that his manager had been buying straw. He was very angry. "A farm," he said, "ought to furnish its own straw; there must have been peculation or mismanagement." He ordered the manager to receive three hundred blows. I was shocked, and ventured to remonstrate; but he kept repeating that his farms must provide their own straw.

"'The next morning I found him on his divan in tears. "A dreadful thing," he said, "has happened to me. The man whom yesterday I ordered to be beaten is dead. You must find out his family, give his widow a pension of one hundred dollars a year, and provide for his children, if he has left any."

"'Mehemet Ali's sons,' continued Artim, 'by his old Macedonian wife, Ibrahim, Ismail, and Toussoun, were all men of ability, far superior to those by his slaves, and they were much better educated; not that they had more learning, but that, as they were born before he was pasha, they escaped the flattery which has ruined the others. Perhaps, however, power would have spoilt them as it spoiled Abbas and Saïd. I once said to Achmed,[1] "You are an excellent man now, but God knows what you will be when you are viceroy!" Abbas was good and Saïd was good in private life.'

"'Which had the most talent,' I asked, 'Abbas or Saïd?'

"'Abbas,' he answered. 'And, though he could speak only Turkish, he talked well and wrote well his own language. Saïd speaks well no language but French; his Turkish is bad, and he cannot write at all. Abbas hated Europeans and European education, but wished to diffuse Turkish education. Saïd hates all education of every kind. Saïd is the bolder man, Abbas was timid. Mehemet Ali used to abuse him for his indolence, and prophesied to him that, if he passed all his time smoking and lolling on his

[1] The heir-apparent in 1856.

divan, he would be assassinated. This prophecy sank deep into the mind of Abbas, and assassination was always uppermost in his thoughts.'

"'I wonder, then,' I said, 'that he ventured to ill-treat or even to threaten the very Mamelukes who kept guard over him!'

"'No European,' answered Artim, 'would have done so, nor would he, perhaps, when he was cool, but in his fits of anger he was mad. He killed several of his Mamelukes—one a few days before his own death—and certainly had threatened the two who murdered him.'

"'What has become of them?' I asked.

"'I believe,' answered Artim, 'that they are still in the army. They have never been punished. Abbas's mother came to Saïd to ask that her son might be revenged; but Mahmoud Pasha, Mustapha Bey, and Elfi Bey, the three persons who first heard of the murder, had all been Mamelukes. To preserve the honor of the corps they made the physicians sign a certificate that the death was natural, and Saïd was anxious that that story should be believed, as he did not wish to put the assassination of viceroys into people's heads.'

"'With whom,' I said, 'does Saïd live?'

"'With his servants,' answered Artim Bey, 'like all Oriental princes. His barber, his bathing-man, his pipe-fillers, form the *fonds* of his society. Then his soldiers, particularly his common soldiers, have free access to him. Turks are fond of low company. They are at ease in it.'

"'Saïd,' I said, 'seems to me at ease in all companies.'

"'For a short time,' answered Artim; 'but he does not like the restraints of polished society, or the sustained conversation of intelligent persons. He has quickness, *à-propos*, and repartee, and some humorous *naïveté*, but there is no sequence in his ideas. He cannot reason. He has dismissed all his council, and turned his ministers into clerks; but so little is he aware of the extent of the duties he has assumed that he wastes four or five hours every day drilling recruits. That, however, is his amusement; and the amusements of a Turk are so few that he must take what he can get. A friend of mine, a native physician, was called in a few days ago by a Turk, and found him dying of dyspepsia, arising from torpor of mind and body. He advised him to ride. "I don't like riding," said the patient. "Then," said the physician, "spend a few hours every morning in your harem." "I hate my harem," was the answer. "Then," said the physician, "count your money for a few hours." "I don't care about money," said the patient. "Then," said the physician, "hang yourself, for how can life be endurable to a man who does not care for his horse, or his wife, or his money?"'"—*Fortnightly Review.*

SUBMARINE CABLES AND THEIR MANUFACTURE.

TWENTY-SEVEN years ago the first submarine cable was laid across the Strait of Dover. This was a single copper wire covered in gutta-percha, which parted next day; and the first practicable submarine cable was laid in 1851, on the same route. Since then the progress of ocean telegraphy has been extraordinary, no fewer than six cables spanning the Atlantic bed—five to North America (although these are not all working), and one to South America by way of Madeira and Pernambuco. And so extensive is the already existing network of foreign cables that, when Asia is united to America by cabling the Pacific, the electric girdle round the world will be complete from east to west, as it now is between north and south.

In this great development of telegraphy our countrymen have unquestionably furnished both the lion's share of the work and the capital. The cables have nearly all been manufactured in London, which is the headquarters of telegraphy.

The principal parts of a submarine cable are: the *conductor;* the *insulator;* and the *protector*, or sheathing. The conductor, as its name implies, is the wire which conducts or conveys the electric current from one place to another. It corresponds to the iron wire of our ordinary open-air or land lines of telegraph. Along this wire, as is well known, the current from the battery at the station from which the message is being sent travels to the station receiving the message, where it passes to the earth, and appears to return through the earth to the battery again, thus *completing its circuit.* There are two distinct parts of the circuit which the current has to traverse—namely, the outgoing part, rep-

resented by the wire or *conductor;* and the return part, represented by the earth itself; and, inasmuch as these two parts must be kept distinct and apart throughout their length, the wire which is laid along the earth's surface must be kept apart from the earth, to secure which the conductor is entirely surrounded with an *insulator*. In land-lines, erected on posts overhead, the wire is separated or insulated from the earth by the air, which is, when dry, the most perfect insulator known; and at the points of support contact with the earth is prevented by the use of porcelain, stoneware, or vulcanite insulators, to which the conducting-wire is fastened.

An insulator is a non-conducting substance, impervious, so to speak, to electricity. It is the theoretical antipodes of a conductor. While the conductor is a substance through or over which electricity flows freely, the insulator will neither permit electricity to pass through its mass nor over its surface. It can, therefore, be used as a means of confining electricity to a conductor, and preventing it from escaping to other conductors in the neighborhood. In short, it can be made to insulate or isolate the particular conductor from all other conductors. Its use in a submarine cable is to confine the electric current to the conductor or wire, so that it travels along it from one station to the other without escaping to the water, and through that to the earth (which, as we have already said, is the neighboring conductor, and the return part of the circuit) on its way. It is, therefore, of course, important that there shall be no flaw in the insulator; and, in order to protect it from strain and violence, it is covered with a strong guard or sheathing. This outer sheathing or protector, which is composed of twisted-metal strands, is purely mechanical. Only the conductor and the insulator are concerned in the *electrical* requirements of the cable.

The conductor is invariably of copper wire, that metal being chosen because, next to silver, which is, of course, too expensive, it is the best metallic conductor of electricity. The metals, as distinguished from most other minerals, are excellent conductors of electricity; that is to say, they oppose relatively *less resistance* to the passage of the electric current through their mass. There is an economy of power in using a good conductor for the telegraphic line. The current is less weakened when the resistance to its passage along the line of wire is less, and it is, therefore, capable of more powerful effects throughout the route, and consequently at the other end. The conductivity or conducting power of a wire increases with the thickness of the wire; and, therefore, by taking a thicker wire of a more common metal than copper (such as iron), the resistance to the passage of the current may be made as small as when a thin copper wire is employed. But it is important that the conductor of a submarine cable, especially of a long one, should be of as fine dimensions as possible, in order to economize insulating material and sheathing, and reduce the total weight of the finished line. Therefore the advantages, in point of price, of iron wire over copper, in the first place, would be greatly overbalanced by the increased cost of insulating and sheathing it. It is of the greatest importance that the copper wire of the cable should be as pure as possible, for the slightest trace of arsenic or other foreign element is sufficient to hamper, in some mysterious way, the swift course of the subtile current, and very materially to weaken the conducting power of the wire.

In a few cables the copper conductor has been made in the form of a single thick wire; but, for the sake of greater flexibility and less risk of breakage, it is generally made in the form of a strand of three or more, and frequently of seven wires—six set round a central one. The wires are wound together in a spiral strand, and their interstices filled with an adhesive substance called Chatterton's Compound, a mixture of resin, gutta-percha, and Stockholm tar. This compound not only renders the strand solid and impervious to water, but also acts as an adhesive connection between the copper conductor itself and the insulator with which it is to be coated. Bound together with this or similar pitchy compounds, the conductor and the insulator form a solid *core* expanding and contracting together.

The insulator is always either of gutta-percha or India-rubber, but most frequently the former; and it is, of course, essential that there shall be no flaw or defect, such as an air-bubble or steam-vesicle, or hair or thread inclosed so as to deteriorate its insulating properties. To guard against such accidents, it is usual to apply a series of coatings to make up the total thickness of the insulator. Accordingly, when one coating has cooled, a layer of Chatterton's Compound is applied to it, and another coating overlaid, and so on, until the required amount of insulating material has been put on.

Whether the insulating substance is gutta-percha or India-rubber, there is generally wound round it a serving of untarred hemp or jute-yarn, which has either been tanned or soaked in brine

as a preservative. This is to act as a padding or cushion for the iron sheathing or protector next to be applied. This serving is applied in the following way: A circular disk or frame, carrying on one face a series of bobbins which hold the threads of the yarn, is kept revolving. The core is made to pass through a hole in the centre of this disk, and the threads are wound spirally round it as the disk revolves.

The iron wires of the sheathing, which completely inclose and cover the served core, are wound on by the powerful "cable-machines," whose operation is so interesting a feature in a visit to a cable-factory. The great revolving disk, seven or eight feet in diameter, is set round with iron bobbins filled with the iron sheathing-wires. These bobbins are *suspended* on the face of the disk, so that as the disk revolves they always preserve their fixed position with respect to the earth. In this way the wires themselves are not twisted round their own axes as they are laid on the core. These wires are generally of the best homogeneous iron wire—that is, a wire intermediate in quality between iron and steel, and uniting some of the toughness of the former to the strength of the latter. They are sometimes themselves covered with a serving of the best tarred Manila hemp; sometimes laid on in single wires abutting against each other, so as to form a smooth and complete casing for the cable; and sometimes they are applied in strands of three wires, each abutting against each other. The composite sheathing of hemp and iron is usually applied to the deep-sea portion of a cable where, in laying, a union of lightness and strength is demanded, and where, when once laid, the cable is not likely to be molested. The single-wire sheathing is applied to cables to be laid in shallower depths, such as coast-waters; and the heavy-strand sheathing is for protecting the cable in anchorages and on sea-beaches. The light-sheathed cable is called "main" or "deep-sea cable;" the medium is called "intermediate;" and the heavy-sheathed cable is called "shore-end." There is seldom more of the last than ten or twelve miles, to carry the cable well out of reach of the abrasion of storm-shifted bowlders and coast-anchorage. The intermediate usually extends until deep water has been reached, where the deep-sea portion takes its place. These three types of cable are connected together by "taper-pieces." The core is, of course, uniform throughout the entire length of the cable; but the taper-pieces serve to connect the different types of sheathing artistically and soundly with each other. The intermediate cable generally has its sheathing-wires covered with a serving of mineral pitch, silica, and hemp of a coarse quality, in order to ward off as long as possible the dissolving action of the sea-water.

The cable being thus finished at the manufactory, it is coiled into large iron tanks, and there immersed in brine until it is shipped for transport and laying.

All the materials of a submarine cable are carefully watched and tested—the iron wire for stretching, twisting, and breaking stress, and the core for all its electric properties. The special properties of every knot or mile of the core are chronicled, so that a complete account of every part of the cable is preserved during its progress of manufacture. And after it is made, it is tested electrically every day, to see that no change takes place in its electric qualities. These electric tests are three in number: For *resistance*—the resistance of the copper wire to the passage of the current. For *inductive capacity* — the amount of charge or quantity of electricity which the cable will take up. For *insulation resistance* —the insulating power of the gutta-percha coating.

These tests are made by direct comparison with units, just as bodies are weighed by comparison with a pound or unit of weight. The unit of electric resistance is the *ohm*; so called after the celebrated German physicist and electrician Ohm. The ohm is the resistance of a certain length of platinum-silver wire determined by a committee of the British Association. Multiples of the ohm are readily obtained, and these are arranged and made up into what are called *resistance-boxes*—the practical tool of the electrician. A resistance-box usually contains coils of platinum-silver wire of from five thousand ohms downward to single ohms or fractions of an ohm. It is with this finely-graduated tool that the electrician compares the resistance; or, in other words, ascertains the conducting power of the cable.

The unit of measurement of the *insulation resistance* of the cable is a very high multiple of the ohm, called the *meg-ohm* or million-ohms; for, inasmuch as the insulator is, technically speaking, a non-conductor, its office is to exercise the necessary resistance to the escape of the current. The unit for capacity is called a *micro-farad* or millionth part of the *farad*, which derives its name from Faraday, and represents a certain *quantity* of electricity. The practical tool for the micro-farad is a contrivance called a *condenser*,

a description of which, without the aid of drawings, would be too technical for our readers. A submarine cable is itself, however, a particular form of such a condenser. The copper wire is one of the opposed conductors, the sheathing, earth, and sea-water, form the other, and these are separated from each other by the insulating coating of gutta-percha. It is a curious fact that when a charge of electricity is communicated to the copper wire of a cable, it *induces* a charge of an opposite kind in the earth outside. This inductive property of an insulated wire contiguous to the earth has an important bearing on practical telegraphy; for, inasmuch as the communicated charge and the induced charge attract each other, the former travels less swiftly along the wire; it is held back, as it were, by the retarding influence of the earth's induced charge; or, in other words, has a tendency to ooze out of the cable instead of traveling uninterruptedly to the other end. It is of consequence, therefore, to ascertain the inductive capacity of a cable; as the less it is, the greater will the *speed* of signaling be.

The resistances and capacity of a cable are usually tested, according to the standards of resistance and capacity—that is, with the ohm, meg-ohm, and micro-farad—by measuring the strength of an electric current passing through the cable, by means of an instrument called the galvanometer, or current-measurer. Its principle depends upon the fact, discovered by Oersted, the famous Copenhagen philosopher, that when a current is sent along a wire in the neighborhood of a freely-suspended magnetic needle, the needle will be deflected into a new position, and this position will be to right or to left according as the current of one kind or the other is sent through the wire. Moreover, the amount of deflection will be directly proportional to the *strength* of the current. This great discovery, which gave an incalculably great impetus to the progress of the telegraph, is the theoretical basis of the galvanometer. One form of this instrument, used to test submarine cables, is called the "reflecting galvanometer," and is the invention of Sir William Thomson. The wire through which the current to be measured is made to pass, consists of a great many turns of silk-covered or insulated copper of a very fine gauge, forming a hollow coil, in the heart of which a very diminutive magnetic needle is suspended by a gossamer-like filament of floss-silk. This magnet (or magnets, for there are generally more than one) carries a tiny circular mirror, the whole arrangement of magnets and mirror being no longer than (⊂). A beam of light is thrown from a lamp in front on to the mirror, and reflected back again on to a graduated pasteboard scale. When the current to be measured is sent throughout the coiled wire surrounding the magnets, they are turned horizontally on their former position, and the mirror is inclined round with them, so that the reflected beam of light is moved along the scale, the distance to which it is moved being a measure of the current strength.

Now, when the current from a given battery or source of electricity is made to pass through wires of different resistances, the strength of the current which will pass through these wires can be made a measure of their resistances; and therefore, when the current from a particular battery is sent through the conductor of the cable or to test the insulator, and in each case measured by the galvanometer, and compared with the current from the same source which will flow through the units of comparison, the copper resistance and insulation resistance can be obtained.

In a somewhat similar way the capacity—the *amount* of electricity which a cable will take—is compared with the capacity of a standard condenser or measure of capacity. The opposite plates or sheets of the condenser are charged by a particular battery; and, as these charges are eager to flow into each other and unite, but are held apart by the insulator, they may be allowed to do so through a wire or other conductor. The discharge of the opposite electricities into one another sets up a short, powerful current in this wire, and its strength is proportional to the quantity of electricity discharged; that is, to the capacity of the condenser. If the coil of the galvanometer be substituted for this discharging-wire the strength of this discharge will be measured by the deflection of the gleam of light on the scale. By charging alternately, therefore, the condenser and the cable from the same battery, and observing their respective discharges by means of the galvanometer, the capacities of the cable and condenser are compared.

The speed of signaling through a submarine cable, that is to say, the number of words per minute that can be transmitted through it, varies with the resistance of its conductor, its inductive capacity, and its length; and it is by a consideration of these properties, together with weight and cost of material, that its form and dimensions are designed; and on this interesting subject we may have a few words to say in a future paper.—*Chambers's Journal.*

GENIUS AND VANITY.

THE critic who aims at the highest triumph of his art, the revelation to the world of unrecognized genius, must often feel a disagreeable qualm. May he not be puffing a charlatan, instead of heralding the advent of a great man? The doubt is still more perplexing when the genius to be proclaimed is his own, and the responsibility correspondingly greater. And hence arises a problem which has often occurred to me when reading about two eminent men of the last generation.

Wordsworth and Haydon were friends. Each sympathized with the aims of the other. Wordsworth wished to reform poetry as Haydon wished to reform painting. Each of them endeavored to breathe a loftier spirit into the devotees of his favorite art. Each of them persevered heroically in spite of the most depressing reception. The enthusiasm which animated Haydon was not less elevated above the ends of a commonplace selfishness than that which animated Wordsworth. If the painter was undeniably vain, the poet pushed vanity to the verge of the sublime. One, however, failed where the other succeeded. Poor Haydon's life-long exertions were not, one may hope, entirely thrown away; but his most cherished ambition came to naught. He produced no work which might entitle the English school to rank among the great schools of the world. Wordsworth, on the contrary, breathed new life even into the rich and vigorous growth of English poetry; he set his mark upon a generation; and enjoyed, before he died, the profound homage of the best and purest minds of the succeeding generation.

Haydon, then, made a fatal mistake, whereas Wordsworth's daring was justified by the result. That is clearly a reason for pity in the one case and congratulation in the other. But is it a reason—as it is certainly a common pretext—for pronouncing a different moral judgment upon the two men? Is success to be the sole test of virtue in this as in so many other cases? When a hero burns his ships, scorns the counsels of cool common-sense, plucks the flower safety from the nettle danger, and ends by winning an empire in defiance of all calculation, we are ready with our hosannas. But, if he fails, should we therefore stone him? If Columbus had met with a little more adverse weather, his courage would not have prevented the failure of his enterprise. Had our arctic voyagers chanced upon a better route, they might have reached the pole without expending more devotion. The hero is the man who dares to run a risk; who is not deterred because an element of the radically unknowable enters into his calculations. If he knew more than others he would be a wiser, but not a better, man than his fellows. He would be playing the great game with loaded dice. His insight, not his daring, would deserve our wonder. But he who risks life and fame upon an uncertainty deserves equal credit, for his intrinsic merit is the same, whether the cards turn up for him or against him. Our life is little but a wandering in a trackless desert. We throw out exploring-parties in every direction. Ten die of starvation and misery; one hits upon the right path. Too often we praise the man already rewarded by fortune, and attribute his good luck to some mysterious power of intuitive judgment. But, if we were just, we should bestow equal praise and more sympathy upon the luckless ones whose steps led them to the barren places, and whose failures, it may be, served as warning beacons to their more favored successors.

Why not apply this rule to the pioneers of intellectual or artistic progress? Hundreds of men have wasted lives of energetic endeavor in following delusive paths in that great labyrinth of human knowledge, where the clew is so hard to find, and where at every stage so many paths hold out equal promise. We, enlightened by slow experience, or by wider knowledge, can see that these wanderings were predestined to failure. But why not honor equally the high faith which scorned meaner aims, and was unchilled by the indifference of the vulgar? Is devotion to knowledge so common a quality that we can afford to despise it unless it bears fruit in appreciable results? We often laugh at the poor would-be philosophers who waste years in trying to discover perpetual motion, or to square the circle. They are, we may be sure, grossly ignorant, and, in all likelihood, intolerably arrogant. They must be ignorant of other men's work, or blind to the vast improbability that they should be right, and all the great intellects of the world hopelessly wrong. Yet, even in this case, pity as much as scorn may be due to the ignorance; and the arrogance itself is but the ugly side or the exaggerated development of the quality which, more

than any other, is necessary for intellectual progress. We have never a sufficient supply of originality and intellectual daring. We always need more men able to cast aside the traditional spectacles, to see for themselves and once more test the dogmas which our indolence tempts us to accept with too easy a faith. Such courage is good, even when misguided. Find men who will dare, and all is possible. Let obedience to authority be installed as the first intellectual virtue, and knowledge will be petrified into Chinese finality. And, if even such eccentricity deserves that contempt should be tempered with mercy, may we not rightfully honor many others who have thrown away their lives, like poor Casaubon in "Middlemarch," in labors fruitless because accidentally misdirected? It is a great misfortune, but it is not a vice, to be an anachronism.

But what are we to say to that great army of martyrs, among whom poor Haydon is to be reckoned—the epic poets, the rivals of Shakespeare, the would-be eclipsers of Raphael or Phidias—the men whose efforts to sing or to paint have supplied the world with mountains of waste-paper, and spoiled acres of good canvas? One of the most pathetic of Balzac's minor stories describes the fate of a poor painter, who had labored for years at a picture destined to create a new era in art. All his hopes in life, his love and his ambition, were involved in its success. No one had been admitted to the room in which he labored with unremitted devotion. At last, the day came when the favored person stood before the curtain which concealed the masterpiece. The painter drew it aside slowly and solemnly, and revealed a meaningless confusion of chaotic coloring. The artist's mind was of course unhinged; but his melancholy story is a symbol of the fate of many men still outside Bedlam. Any one who has seen the darker side of the literary and artistic worlds can match Balzac's hero with numerous instances of similar self-delusion. The pictures are not often mere random blotches of color; the poems frequently obey the laws of grammar, and even of metre; but, for all good purposes, the artist might as well have thrown his brush at the canvas, or the author taken his words at random from the dictionary. And what should be our feeling? Contempt or pity or admiration for the devotion, combined with compassion for the error? Should we honor, say, a Chatterton who is a martyr to his ambition, because the poems unrecognized during his lifetime turned out really to have something in them (though, after all, not very much!), and despise the numerous Chattertons who have hopelessly failed, because there was nothing in them at all? The moral quality was the same. The difference was, that one man judged his powers rightly, while the hundreds judge of their powers wrongly. But this is an error to which almost every man is liable. Our squarers of the circle are silly, because they can appeal to a court which is practically infallible. A hundred professors of mathematics are ready not only to tell them that they are wrong, but to explain to them how and why they are wrong. But the poet can appeal to no such court. If he is not appreciated, it may be that he is in advance, not in rear, of his time. A century hence, his work may be winning recognition, and his descendants be ridiculing the blindness of their ancestors. Why, then, should he not persevere, and trust his work to time? Do we not, in any case, owe to him the tribute of admiration for a devotion of which it is premature to pronounce that it was directed to a mistaken object?

The easiest answer is, that a false estimate of our own merits is in fact immoral. Vanity is weakness which we can all condemn unreservedly, because we all feel that we are free from it ourselves, and recognize its existence throughout the rest of the species. The appointed chastisement of vanity is ridicule. Therefore we are right in laughing at the man who thinks himself to be a Milton when he is merely a Satan Montgomery. The victim may reply that we are begging the question, and that what we call his vanity will hereafter be called consciousness of genius. And, in truth, the dilemma is in one sense insoluble. Critics are fallible; cliques are fallible. The outside public is so fallible as to be generally wrong; no literary court is infallible except that to which the best minds of all ages are admitted as judges, and in which many of our most dogmatic utterances would look foolish enough. Yet we must take our chance. Judges must sentence prisoners, though now and then they may condemn an innocent person. Critics must laugh at charlatans, though they may now and then mistake a man of genius for a fool. But there is a more fundamental difficulty. Granting that a man's confidence in his own powers really implies vanity, are we, therefore, justified in condemning him? Is vanity a vice at all? Is it not in any case a vice so universal that none of us have a right to cast the first stone? Nay, if we lay aside the conventional attitude of mind, in which our little cut-and-dried maxims pass for legitimate currency, ought we not rather to

call vanity a virtue, or at lowest a desirable quality? Listen to the ordinary moralizing of the pulpit and the moral essayist, and we, of course, must condemn vanity, as on the same showing we condemn many of the most essential qualities by which the world is carried on. There is a sense—nobody denies it—in which these commonplaces have a sound, if a rather obvious, meaning. But all maxims that have been much used by preachers—lay or clerical—become so strained and perverted in the process that, like worn-out muskets, they are apt to produce very random shooting. Who that has looked at the world for himself can deny that vanity may be reckoned among the most enviable of possessions? It deserves, even more than the original object of the panegyric, the praise which Sancho bestowed upon sleep. Vanity does indeed wrap a man up like a cloak. It bestows its blessings freely upon the poet striving against general misappreciation; it enables the poor loser in the great battle of life to make himself happy with some trifling success; it softens the bitter pangs of disappointment and gives fresh strength for new struggles; it prevents resentment and facilitates the intercourse of society; it can make any man contented with his lot, and lets the poor drudge in the kitchen think without envy of the statesman in the parlor. Who would not be tempted to frequent irritation if he could enjoy that gift for which the poet so foolishly prayed, the gift of seeing himself as others saw him, and recognize his infinitesimal importance in the eyes of his fellows? It is because of the tender illusions of vanity that a man can accept the petty sphere of his own activity for the wider circle of the world, and shut out the annihilating image of the vast forces beyond. It is the safeguard against a depressing fatalism. Vanity has as many virtues as the vaunted panaceas of medical quackery; and, were it not for that softening oil, the wheels of life would grate harsh music too discordant for mortal ears.

Yet in singing the praises of vanity we become aware of a certain vagueness of outline about this Protean goddess. She can take many shapes; and changes so rapidly and completely that we are unable to fix any definite portrait upon our canvas. Sometimes there is a scowl upon her features, and sometimes a complacent smile. She can pass herself off in the likeness of her conventional opposite, humility, or ape the gestures of pride, or be undistinguishable from mere sullen egotism. All our definitions of the passions have this provoking vagueness, because, in truth, we do not know what are the ultimate elements of character. We cannot find chemical formulæ for human nature, or say how many atoms of spiritual oxygen or hydrogen must be combined to form a definite product. Our efforts at analysis break down at every instant. Every new light thrown by new circumstances brings out previously unsuspected aspects of bewildering complexity. Every new character seems to require a new category for its description. There seem to be as many species of men as there are individuals. Our complacent little formulæ may guide our conduct with tolerable accuracy; but, when we confront theory with the infinite variety of facts, we recognize the futility of any claim to scientific accuracy. We class men as good or bad, humble or vain; and when looking at exceptional cases, or dealing only with large classes and average results, our words have a kind of meaning. The saint and the sinner, St. John and Judas Iscariot, may be distinguished easily enough. But between the extremes we may interpose any number of terms, varying so strangely, in so many directions, and combining so many apparent contradictions, that our lines of demarkation become hopelessly blurred and confused. Our compartments may be most logically subdivided, but no real being will quite fit into any one of them. The inferior classes multiply on our lands; they cross, blend, overlap, and confuse each other till we admit them to be useless. We can seldom apply a rule to a dozen cases without finding twelve exceptions. The qualifications to our statements become so numerous that the statements are practically worthless. The poet can create characters; the man of science cannot define them or assign their composition.

Thus the condemnation of vanity collapses when we try to answer the plain question, What is vanity? Try to define accurately the various cognate terms, vanity, conceit, pride, egotism, and their numerous allies, to mark out accurately their points of resemblance and contrast, and then test your conclusions by appropriate examples. Take a few cases at random. Here is Miss Martineau, for example, who says in her autobiography that all the distinguished men of her time were vain—and she does not add that the limits of time or sex are a necessary part of the assertion. But was she not vain herself? No, for she formed a singularly modest and sound estimate of her own abilities. But again, yes, for she certainly seems to have considered that to one person at least Miss Martineau was incomparably the most interesting person in the uni-

verse, that coming generations would be profoundly interested in the analysis of her character and the genesis of her works, and also that the merits of her contemporaries might be accurately gauged by the extent to which they did or did not sympathize with Harriet Martineau. Is not egotism of this kind mere vanity disguised by a superficial air of impartiality? Take the vanity, again, which is revealed so curiously in the recently-published letters of Balzac. Here it becomes a force which leads a man to reckon himself among the four greatest heroes of his age, and goes far to make him what he supposes himself to be. It develops a kind of monomania leading to utter absorption in his own affairs, in his literary ambition, and, above all, in calculations as to the number of francs into which his genius can be coined. Was it a strength or a weakness? Contrast it with the vanity—for many people will call it vanity—of his contemporary Doudan. Doudan's letters reveal to us a man of that admirable fineness of intellect so conspicuous in the best French writers, which may be defined as the sublimated essence of common-sense. But his exquisite sensibility was pushed to such a point as to destroy his fertility, and but for his letters his name would have been known to his fellows only through a passing allusion of Sainte-Beuve. Shall we say that Balzac's vanity led him to produce the "Comédie Humaine," and Doudan's humility made him produce—nothing? Then vanity is so far a good and humility a bad thing. Or shall we say that this excessive sensibility is but vanity disguised?—that a man who trembles before criticism thinks too much of his own importance? The theory is a common one, and enables us verbally to condemn vanity in all forms; but it implicitly admits, too, that vanity may produce diametrically opposite results, and at times coöperate hand-in-hand with humility.

Infuse vanity into such a man as Goldsmith, and it adds a childlike charm to his character; it gives a tinge of delightful humor to his writing, and enables his friends to love him the more heartily because they have a right also to pay themselves by a little kindly contempt. Make a Byron vain, and half his magnificent force of mind will be wasted by silly efforts to attract the notice of his contemporaries by attacking their best feelings and affecting (a superfluous task!) vices which he does not possess. The vanity of a Wordsworth enables him to treat with profound disdain the sneers of Edinburgh reviewers, and the dull indifference of the mass of readers; but it encourages him also to become a literary sloven, to spoil noble thought by groveling language, and to subside into supine obstructiveness. Conversely, the vanity of a Pope makes him suffer unspeakable tortures from the stings of critics compared to whom Jeffrey was a giant, condescend to the meanest artifices to catch the applause of his contemporaries, and hunger and thirst for the food which Wordsworth rejected with contempt. But it also enables him to become within his own limits the most exquisite of artists in words; to increase in skill as he increased in years; and to coin phrases for a distant posterity even out of the most trifling ebullition of passing spite. The vanity of a Milton excites something approaching to awe. The vanity of a Congreve excites our rightful contempt. Vanity seems to be at once the source of the greatest weaknesses and of the greatest achievements. To write a history of vanity would be to write the history of the greatest men of our race; for soldiers and statesmen have been as vain as poets and artists. Chatham was vain; Wolfe was vain; Nelson was childishly vain; and the great Napoleon was as vain as the vainest. Must not our condemnation of the quality undergo some modification before we can lay it down as an absolute principle?

If, to set aside some ambiguities, we declare that man to be vain who, for whatever reason, over-estimates his own merit or importance in the world, we shall naturally infer that vanity is so far bad as it implies an error. A man is the better for knowing the truth, in this as in all other cases. But we may still ask whether the error is of such a nature as to deserve moral disapproval. We do not blame a man because he gives the wrong answer to one of those problems which have tasked the ingenuity of countless thinkers of the highest ability. The difficulty of discovering the truth about one individual, especially about our own individuality, is as great as the difficulty of discovering the truth about a general problem of philosophy and theology. The moralist who, in this latter case, admits that sincerity is no guarantee against error, orders men to be candid, but cannot order them to arrive at right conclusions. A mistake in judgment is not wicked, precisely because mistakes are the necessary consequence of candid examination by our imperfect reason. Sincerity, not infallibility, is our moral duty. Similarly, it is right to judge of ourselves as fairly as we can; but the difficulties which beset the task of at once seating ourselves on the bench and taking our place at the bar are so great, that the least prejudiced of self-critics will

often blunder. The sanguine observer will differ from the melancholy; the man of quick sympathies will be more apt to be affected for good or evil by his neighbor's judgment than the man whose affections may be stronger though less mobile; the excitable man will be led into one extreme or the other more easily than the phlegmatic; a vivid imagination predisposes us to accept a set of tests different from that which would commend itself to the severe logician; and, moreover, a man's judgment of his own character will vary from day to day, like his judgment of all other matters, according to the state of his liver or his banker's balance. All these—and many other—difficulties are so inevitable that we must look with compassion upon a wrong estimate so long as it is not palpably due to some irrelevant cause. Only when a man is vain for some bad reason—because he has a longer purse or a more uncommon disease than his neighbors—and cases of far more eccentric judgment are not uncommon—he is admitting evidence which he clearly ought to have excluded. The errors of the judge in this case imply not only fallibility but corruption; he has taken a bribe from some of his passions, and he deserves some of the indignation due to such unworthy leanings.

I am, you say, capable of being a great poet; my talents shall not be lost to the world; I will brave poverty, anxiety, contempt; my fellow-creatures may repent their indifference, and render a tardy homage over my grave or to my declining years. Brave words! but words as easy to the fool, the knave, and the charlatan, as to the neglected martyr of the race. Is your first judgment beyond all suspicion—not only of error but of sincerity? Are you not biased by some baser motive when you pronounce yourself to be one of the elect? If you really hold that your wretched dribble of mechanical metre is equal to the mighty harmony of a Milton, you must be wanting in ear for the music of verse; if you take your tinsel-decked platitudes for the passionate utterance of a great intellect, stirred to its depth by the sadness of the world's tragedies, you are probably deficient in philosophical insight; if you cannot see the difference between your conception of the world as a gigantic pot-house, or a magnified stock-exchange, and that which represents in their full force the purifying and ennobling passions, it is probable that there is a gap or two in your morality. Making all allowances for the difficulty of self-judgment, there remains a strong presumption that the man who takes a daub—even a daub of his own manufacture—for a true masterpiece is deficient in the power of sharing as well as in the power of uttering the loftiest thoughts. You cannot put colors on canvas because you cannot see them in Nature. Your artistic standard is low because you are incapable of the high emotions which it is the true function of the best art to express, and the full utterance of which is the one true test of artistic excellence. You appeal to vulgar tastes because you are wanting in innate refinement. It is due to other bad qualities if you take size for sublimity, contortion for force, intricacy for subtilty; if brutality appears to you to be strength of feeling, and sensuality to be masculine vigor. If you succeed, you are a charlatan; and, if you fail, your failure is deserved. Your vanity is the index, not of the inevitable illusion of self-contemplation, but of a mean, or narrow, or degraded nature.

Such a verdict would be inevitable, if the power of representing were always proportioned to the power of feeling emotions; if productivity and receptivity were but opposite forms of the same power. Notoriously this is not the case. Silence may sometimes indicate a defect of the organs of speech, not an absence of thought. Many a man enjoys Nature heartily who cannot put together two lines of description; and yet he may fancy himself to be eloquent, because he naturally infers that the clumsy phrases which express his own sentiment must express the sentiments of others. Molière's old woman is a typical case. Thousands can enjoy for one who can create, or even assign intelligible reasons for his judgment. Unluckily, many such old women fancy that their appreciation of their Molière entitles them to write comedies. The weakness is an amiable one. We ought to pity those poor dumb poets who have music in their souls, and strive in vain to embody it in artistic shape. So long as they do not insist upon our reading their verses, we will tolerate and even love them. Sincere devotion to art is perhaps most touching in those to whom art never makes any return of praise and success. But it is the more necessary to distinguish clearly between these victims of an innocent delusion and those whose delusion implies incapacity, not only to produce but to enjoy. One class worships at the true shrine, though its offerings are poor; the other grovels before an ugly idol, because it is dead to the true instinct of veneration, and admires the reflection of its own base passions.

How shall we tell whether the vanity of an artist be of the noxious or innocent kind? The

most applicable test is perhaps to be found in the nature of the alleged motive. When a man says or insinuates that his primary object is the good of the world, we may reasonably set him down as a humbug. The transparency of the pretext is too obvious; and the implied belief that his final success is really a result in which the world at large can be seriously interested, indicates a vanity too gigantic to be quite innocent. In truth, there are two and only two excuses which can be accepted as a sufficient justification for adding to the masses of existing literature. One is, that you want money; the other, that you cannot help it. Johnson went so far as to say that any man must be a fool who wrote for anything but money. The statement is a little too sweeping; but we must admit—when it is genuine—the plea of necessity. Writing, at all events, is an honest trade, provided that the author does not lie or flatter base passions. It is rather difficult for a professional author to comply with that proviso; but, so long as he supplies good, wholesome food, sells his wares for what they are worth, and pretends to no higher motive, he is an innocent and even useful member of society. He may rank with other honest tradesmen, and is at least as well employed in selling his literary talents to publishers as a lawyer in selling his rhetorical powers to attorneys.

The best work, indeed, is probably ascribable to loftier motives. It has been accomplished not under pressure of want, but because an active mind, dominated by new thoughts, or set on fire by an imaginative impulse, is constrained to utter itself in some way to the world. It must speak or burst; action of some kind is an imperative necessity; and it is a question of circumstance and character whether the impulse spends itself in producing philosophy, or poetry, or art, or practical activity. The spontaneity characteristic of such work is the quality which determines whether a poem is to live or to die; it is the discriminating mark between the manufactured article and the genuine organic growth. The test, of course, covers that other variety of literature —including much of the very highest—in which the writing is considered not as an end, but a means; where the polished style and strict order are the symptoms of an intense desire to accomplish some ulterior object—to strike down a pestilent fallacy, to encourage the supporters of a good cause, to disseminate ideas which may lift mankind to a higher social order. In such cases a man may be excused if he is eager for some testimony of success. The degree of attention which he excites is the measure of the work which he has done. He looks for praise as the artillery-officer looks for the cloud of dust which shows that his shot has struck home at the right point of the hostile lines. Unluckily, there are many people who seem to be content so long as they can make the dust fly, without reference to the means adopted or to the purpose contemplated.

This is, in fact, the motive which is excluded by our suggested tests. The affected desire to do good to the world means really a desire that the world may sing our praises. The love of praise as praise, the simple appetite for incense, as thick and stupefying as may be, is the really bad symptom, as it is the bane, of our modern literature. This is the true mark of the charlatan, and the natural fruit of that kind of vanity which deserves all the contempt that can be poured upon it. No stings can be too severe which help to kill down the noxious swarm of parasites which find their natural food in the fulsome stream of adulation. For, unluckily for us, there was never a time when this weakness was so prevalent, because there never was a time when the power of advertising, and therefore of winning notoriety without attaining excellence, was so enormous. The evil tends to corrupt the highest and most sensitive natures. A man can scarcely keep his head, when the voice of real sympathy is drowned by the chorus of insincere jubilation. By an anachronism—which has too many parallels—we are still employed in denouncing an excess which has long been supplanted by its contrary. We abuse the severe critics who quench youthful genius. The true evil is different. The really mischievous persons are those appreciative and generous critics who force all eminent writers to live, whether they wish it or not, in an atmosphere so thick with the fumes of incense as to be enervating to the strongest constitutions. A clique is notoriously bad; with our customary twaddle about generous criticism, we are going far to make the whole literary world into one gigantic clique. Youthful genius is no longer crushed—it is puffed into imbecility. We long for some of the bracing air of the old slashing criticism, which, if it caused much useless pain, did at least promote the growth of tough fibres instead of fatty degeneration of tissue.

But, leaving this aside, let us assume that a man's vanity is harmless and his ambition pure. He really thinks that he can bestow upon his fellow-men gifts of truth and beauty. He fancies, to put the case distinctly, that he can produce a new "Hamlet." He sees that he must choose be-

tween his bread-and-butter and his literary ambition. Which course deserves our approval? Shall we praise him for daring greatly or for listening to the voice of respectability? If we prefer the more venturous course, we must, of course, admire the Haydons, and many men without Haydon's talent, who have been martyrs to their courage. If not, we prefer Philistia to Bohemia, and sympathize with the numerous parents who have condemned Pegasus to harness. There are, it is to be observed, two distinct problems: First, we may ask whether it is better to pay your bills or to produce a "Hamlet?" Secondly, as nobody can be certain that his work is really a "Hamlet," we must ask whether it is better to pay, or to take the chance of producing what may possibly turn out to be a "Hamlet?"

Most people will answer the first question with little hesitation. Better, they will say, that Shakespeare's butchers, bakers, and landlady, should have gone unpaid, though want of payment had meant starvation; better that the debt should have gone on accumulating at compound interest from that day to the present, than that "Hamlet" should have been burked. What would be the loss of a few tradesmen compared to the loss of one of the few imperishable monuments of human genius? The two things are not comparable. A man who could pronounce against "Hamlet" would be capable of breaking up Westminster Abbey to mend the Thames Embankment. But is this so very clear? Are we perfectly certain that our valuation is just? Assuming that "Hamlet" deserves all the praises it has received from Shakespeare's most slavish idolaters, I confess that I should still have certain twinges of doubt. What, after all, is the worth of any creation of human genius? What is the proportion between the value of a work of art and the artist's ordinary discharge of his daily duties? What—for that seems to be the real question—is the value to the world of its greatest men? What is the value of a Shakespeare, as measured against the value of an honest grocer?

We cannot adjust the proportion to a nicety, nor even with approximate accuracy. The right point would doubtless lie somewhere between the extravagance of the hero-worshiper and the deprecatory view of that kind of spiritual democracy which holds that the individual is nothing and the multitude everything. But it is equally clear that the average opinion has been hitherto deflected from the true line by the enthusiast far more than by the cynic. The more we know, the more clearly we realize the vastness of the debt which even the greatest owe to their obscure contemporaries. Every advance of criticism diminishes the share of glory due to the great man, and increases the merit of his coöperators. History sees everywhere, not the work of a solitary legislator, but processes implying the slow growth of many generations. The scattered stars of the firmament are but bright points in vast nebulæ revealed by closer observation. In art, the importance of the social medium, relatively to the single performer, assumes ever greater proportions. But what is this but to diminish the extravagant value attributed to single performances? Their intrinsic excellence may not be lessened, but we must lower our estimate of their importance as self-originated and creative forces. "Hamlet" may be incomparably superior to "The Maid's Tragedy" or "The Duchess of Malfi;" but we must admit that Shakespeare was but a coöperator with Fletcher and Webster. The general character of the period would not have been greatly altered had Shakespeare died of the measles; though it would have left behind it a less superlative relic. The disregard of the second-rate performers has fallen in with the tendency to adulate success. What passes for criticism of great men has become a mere competition in extravagance. Each man tries to raise a loftier cloud of incense, and grovel more profoundly in the dust. He wins a cheap praise of generosity and generality by tacitly depressing the mass, in order to give a more imposing air to the pinnacle on which he erects his solitary hero.

Without speaking, however, of those monstrous accumulations of hyperbolic panegyrics which form the monuments of our great men, we should rather alter our view of the importance than of the excellence of the supreme poets and thinkers. Let them tower above their fellows as much as you please. Say, if you will, that the powers implied by the greatest achievements are different in kind, as well as degree, from those possessed by their humbler brethren. Still it will remain true, first, that the greatest of men is but the organ through which thoughts and feelings common to thousands and millions of his fellows find their fullest expression. He is not an isolated phenomenon dropped into the world from without, but the finest of flowers, which appears when the soil and the atmosphere are fully prepared for his development. Cut the flower down, and it could not be replaced; but its disappearance would have but a minor influence upon the conditions to which it was due. The same conceptions of the world and of man's place in it

would mould the thoughts of the time, though they would be less sharply impressed and less obvious to their successors. And, in the next place, a man's influence upon his own contemporaries is that which is incomparably the most important. We are what we are because Shakespeare's contemporaries were what they were: and, doubtless, Shakespeare's influence in forming them must count for something. But we are not what we are because we read Shakespeare's plays. Of course, we derive a good deal of pleasure from them. They influence our literature—very often for evil—and they supply us with innumerable quotations and imaginative symbols. But their effect upon the race is almost a vanishing quantity. For, first, not one man in a hundred reads them; secondly, of those who read, few understand; and, finally, of those who understand, few can count the influence of any particular author as among the forces which have really moulded their lives. Do half a dozen men in a generation really trace any great spiritual change to the power of any one writer—especially of a distant period? This is indeed a point upon which we willfully deceive ourselves, and, doubtless, the implied assertion may at first sight be denied. But let any man examine frankly what are the forces which have really moulded his nature. He has been profoundly affected by his family, by his school, by his profession; by the religious faith in which he has been educated; by the moral standard accepted around him; and sometimes by the artistic tastes and intellectual biases which are prevalent in his day. But how many men can say frankly, after real self-examination, that their characters have been altered or their views of life materially modified by reading any author, whatever his fame, who died even a century ago? So far as he affected the development of the thoughts and history of his race, he has, of course, affected the development of all subsequent time. But I speak of the direct influence—of the difference between our character as it actually is, and that which it would have been if we had not read a particular book of a past century. A few literary persons will, of course, attribute great weight to such readings, and literary people generally speak as if they were the whole world. They are really, I fancy, a superficial ornament, counting almost for zero in the great forces which really move mankind. But, of course, this is a sentiment not to be indulged even in private.

If, however, there be any share of truth in these statements, they naturally limit our estimate of the value even of the greatest works. Every man has an influence, powerful in proportion to his character, upon his own circle. That will be exerted, whether he wishes it or not, and whether he puts his thoughts in print or expresses them in life. His influence as a writer reaches and affects—often very deeply—a wide circle of congenial minds, who are prepared to receive his teaching. Beyond that circle, again, he has a vague influence upon people who may hear his name and think it becoming to have some opinion about him. But this last influence, if it deserves the name, is one which no wise man should desire, and which has but a small and uncertain effect. Why should I care whether a number of ignorant people clatter about my name or not, when of me, as I really am, they are radically incapable of knowing anything whatever? Yet the knowledge which an indifferent contemporary has of a Shakespeare is probably as vivid and as influential as the knowledge of any but the very finest critics in the later generations, when the writer's language is already growing dim, and his thoughts are embodied in unfamiliar images. Even of great men it may be true that their influence either upon their children, their friends, or their dependents, is far more important than that which they exercise by direct communication with distant ages. The most powerful voice becomes faint as it spreads into ever-widening spheres. It then becomes but the ghost of a real utterance—a faint murmur of half-forgotten meaning, loud enough to be heard in the study, but not to guide men amid the rough shocks of vivid present experience. My relations to my butcher and baker belong to the inner sphere, where my influence is still potent, and my dealings with them may be more effectual than my dealings with posterity, though bearing upon smaller matters.

But you cannot be certain that you are a Shakespeare, or even distantly akin to Shakespeare. The difficulty of judging ourselves, which makes error venial, makes dogmatism madness. Nobody has a right to say positively that he has drawn the one prize out of the many million blanks. The English writers of past centuries, whose books are still alive for any but professed students, may be counted on the fingers. Granting that you have talents, and even genius, the probability that you will be added to the sacred band, instead of perishing with the unknown rank and file, is almost infinitesimal. The lad who runs away to sea, in hopes of becoming an admiral or a Captain Cook, is scarcely making a less judicious venture. Genius is rare enough, and it is the rare exception when even genius

bears its perfect fruit. The Shakespeare is not merely the man of greater power than his neighbors, but that particular man of great powers who appeared when the times were ripe and circumstances propitious. To stake your happiness on the chance that you are an exceptional being under exceptional circumstances is, to say the least, daring to the verge of rashness. But, if I do not, the world will lose its chance of another great poet! Make yourself easy; the world will get on perfectly well. Nobody is so great in politics, but that society could struggle along its path of development without him; nor so great in song, but that somehow the emotions of the world will find some channel of utterance. Death—to our ignorance at least—is like a dark power stalking through the world, striking left and right at random, crushing the happy and leaving the miserable, and destroying the genius as well as the fool. But his blow never strikes an individual with whom we could not dispense. Thought will continue to push along every line of development. The disappearance of one inquirer only transfers to another the discoveries which are held to confer immortality; the social problem is being worked out by unconsciously cooperating millions, and they will find a leader to replace the old one; if one man is removed, posterity will have to inscribe the name of the immortal Jones in its pantheon instead of honoring the immortal Smith; the problem may be solved a day later or a day sooner, and there may be some differences in the terms of the answer; but the answer will be found, and must be the same in essence. The great man puts the clock on; he does not determine the direction of its movement. And it is equally true that when thoughts are fermenting in the mind of age, and new aspects of Nature become conspicuous, and new emotional phases diminish utterance, people will be found to provide the imaginative symbols fitted for the embodiment; and the man who does at last will be regarded as the creator instead of the product. At any rate, it is quite needless for any man to fret himself about the fate of the universe. There are within this realm five hundred, probably five thousand, as good as he, and those will do best who leave the world and their fame to take their chance, and aim only at doing the work which lies next to hand.

Leave the universe alone. When a regard for the interest of things in general is not hypocritical, it is the very madness of arrogance. Here, as in so many cases, it is the law, though it is an apparent paradox, that a man contributes to an end most effectually by putting any direct reference to the end out of his mind. Here, indeed, is a plainer, if not more powerful, consideration. Is not the supposed act of heroism a folly in any case? It requires courage to neglect one's bread-and-butter in order to to win glory; but what if the neglect of bread-and-butter be the shortest way to wreck your genius as well as your prospects? Good work, as a rule, is only done by people who have paid their bills. Why was Shakespeare so far ahead of all contemporary dramatists? Because Shakespeare had the good sense to make money, and was therefore able to command the market, and write his later works without undue pressure. Others could only write in a tavern, or to get out of a creditor's clutches. Shakespeare's mind was at ease by the consciousness of his comfortable investments at Stratford. "Hamlet" was written because Shakespeare was solvent. Pope was able to polish his verses because he judiciously made himself independent by his "Homer." Wordsworth, like Haydon, wished to shake the world; but, unlike Haydon, he recognized and acted upon the truth that the first condition of such power is personal independence. Live for art, if you will; but first be sure that you have not to live by your art, otherwise the only harvest that you can reap will be that of the first reckless ebullitions, when the responsibility of life does not weigh upon the buoyancy of youth. Some good work has come out of Bohemia; but any one who sojourns permanently in that seductive region is sure to lose his vigor as well as his money, and produces in the end mere scraps and outlines and rough indications of what he might have done. When we are asked to consider how much may have been crushed in poets condemned to writing ledgers, we can only reply by pointing out how much has certainly been lost by poets who have run to seed in sponging-houses. From the days of Marlowe to those of the unhappy Edgar Poe, we have innumerable warnings that genius runs to waste when it does not condescend to be respectable.

We have fallen upon a very commonplace and humble moral. It is none the worse for that, and certainly not the less often overlooked. The truth which it is really important to enforce more than ever is the simple one that all really good and permanent work is the expression, not of a single mood of passionate excitement or prurient desire for enjoyment, but of a mind fully developed, strengthened by conflict with the world, and enriched by reflection and ex-

perience. The first condition of such a development is independence of spirit, which is seldom obtainable without independence of pocket. The first, though not the loftiest, duty of man is to pay his way; though it must, of course, be added that limitation of wants, rather than increase of means, is the legitimate mode of securing that object. If, like Wordsworth, you think that you can be a great man by living upon bread-and-water, you are certainly right in not aiming at the vulgar prizes of money and preferment. But a career is honorable even if it fails; and we may safely honor the man who limits himself to a modest livelihood in order to devote himself to great work. The evil is, that most men want to have both advantages; to live splendidly, and yet to stake their means of living upon literary fame; to gain the praise of the world as well as the praise of posterity; and, in short, to set about a campaign which can only be justified by success without counting the cost beforehand. That is why so many men of genius run to seed, and so many men of no genius fancy that they are acting nobly when they neglect their ordinary duties in search for glory, and fancy that the greatness of their ambition is an apology for the imperfection of their work.

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CHRISTIANITY AND PATRIOTISM.

By the Rev. RICHARD F. LITTLEDALE.

AMONG the many objections alleged in the present day against the moral completeness of Christianity as an ethical code, that which is perhaps most frequently urged is that it gives no encouragement to the virtue of patriotism, and that it is not only strictly incompatible therewith in theory, but has in fact usually tended to its depreciation, if not to its abandonment in practice.

There is an element of truth in the indictment, though very much smaller than its advocates suppose, so that it is desirable to inquire into the details of the subject, under the following heads:

1. What circumstances in the origin and first growth of Christianity were likely to influence the mind of the Church on the matter?

2. How far is patriotism really a virtue?

3. What is the historical evidence as to the relations of Christianity and patriotism?

4. What has given rise to the impression, so far as it has a basis of truth, of antagonism between them?

Now, as regards the initial question, it is to be remembered that patriotism, as a living sentiment, was found in only one corner of the Roman Empire at the time when Christianity began to make itself felt as a social power. The all-embracing tyranny of the conquering race had crushed out the spirit of local independence everywhere that the legionaries could march, and from the time of the Social War it had gradually become the fixed policy of the central power to substitute the idea of Roman citizenship, full or partial, for that of national life. This policy reached its climax under the Emperor Bassianus, by whom the freedom of Rome was conferred on every municipality within the state. The centralizing tendency of the government further impeded the growth of local feeling; and, though in the frequent struggles for the purple we find particular regions and provinces tending to split off under their favorite claimants into independent empires, as in the cases of Carausius and Allectus in this country, yet, if patriotism played any part at all in these civil wars, it was a wholly subordinate one. And when, later on, the empire broke up under the irruption of the Teutonic and allied races, the new invaders had, of course, no habits of attachment to the soil where they settled down as occupants, nor any hereditary associations with it. Their patriotism, if the word may be used in such a collocation, was purely tribal, and it was to the Gothic, the Vandal, or the Burgundian king, not to the territorial ruler of such a portion of Italy, Gaul, or Spain, that the warriors of his race gave their allegiance. In a word, Rome had killed patriotism, and the barbarians had not generated it at the time when the tendencies of the Christian Church had not been merely developed, but formulated. The sentiment was not there to work on or be guided, and it will hardly be contended that it was in any sense the duty of Christian teachers to endeavor its revival. A very weighty reason most natu-

rally operated the other way. The one exception to the general decay of patriotic feeling under the empire was the Jewish nation, and it cannot be said that patriotism, as interpreted either by the Pharisees of the Sanhedrim in Pilate's days, by John of Giscala under Titus, or by Bar-Cochab in Hadrian's reign, was at all likely to win admiring converts from outsiders. In fact, until Christianity rose against the narrow spirit of Hebrew nationality, and threw open the doors of the Church to all the Gentile world, it was practically a mere sect or school of opinion within Judaism, and could no more have affected the Aryan races than the Essenes did. From the moment when Paul of Tarsus laid down the broad principle that in Christianity "there is neither Greek nor Jew, circumcision nor uncircumcision, barbarian, Scythian, bond, nor free," he proclaimed a more comprehensive citizenship than that of the Roman Empire itself (which, even within its own borders, included multitudes of unenfranchised *peregrini* and *servi*), one, in truth, coextensive with all humanity, an idea even less compatible with patriotism, as popularly understood, than the unifying process which the mistress of the world applied to her subjects. On the other hand, those Gentile converts who had left the narrow limits of Judaism behind were themselves excluded from political life for nearly three centuries, owing to the manner in which the state religion permeated official acts, as completely as Protestants were unenfranchised in the Pontifical states till the temporal power fell; and, therefore, could not learn by experience the virtues of acknowledged citizenship in a secular dominion.

It would seem, then, that as we feel here in England a certain tendency to contempt for that local attachment and sympathy which cannot pass beyond the limits of a single village or parish, and do not begin to treat it with any respect till it is at least conterminous with a shire or county, nor to look on it as a virtue till it embraces the whole nation, deeper thought would lead us to recognize in the enthusiasm of humanity at least as much nobler a sentiment than the patriotism of nationality, as this in its turn is nobler than the mere *politique du clocher*. And so far as Christianity holds out the higher ideal, as it must wherever the Pauline principle has been fully acknowledged, this loftier conception supplants, in the finest minds, the inferior and localized one. This is, one would apprehend, a merit, not a fault, in Christian ethics. Why it has assumed the semblance of a fault will be considered a little later. At present a prior question needs to be discussed.

Is patriotism, as popularly understood and acted on, a virtue at all? The historian and moralist can hardly give any reply save No. Indeed, the chief reason for hesitating at all upon the subject, when fairly considered, proves to be the glamour which the intellectual brilliancy of Greece, or rather of Athens, and the political might of Rome, cast upon the imagination, enveloping in a golden haze ideas and actions which will not bear the daylight of pure morality or of social philosophy. It is difficult to estimate now the hurtful influence which the narrow civic patriotism of the ancient Greek commonwealths, constantly finding vent in wars of one petty state against another, must have exerted on the Hellenic race, and the quantity of sheer suffering which it must have occasioned; though we may get some insight into the matter by noting the mental barrenness of Sparta, and the evils of its hyper-military organization. But even in the case of Athens itself, should we succeed in forgetting that it was no true commonwealth, but a civic oligarchy resting on a far larger population of slaves and serfs as a basis, an impartial investigation of facts compels acknowledgment that zeal for the aggrandizement of the City of the Violet Crown proved incompatible with the discharge of higher duties toward the allied and dependent states, not to say of the race in general, in respect of its struggle against the great Asiatic power. It is only necessary to refer to the misappropriation of revenues intended for national defense to the adornment of Athens with buildings having no federal character, in order to recognize the justice of the sentence by which her headship over Greece was lost, and to understand something of the truth. Nor is Athens alone to blame for this spirit. Four of the very noblest names in the records of patriotism that all the rest of Greece can produce, Epaminondas, Cleomenes III., Aratus, and Philopœmen, all fail when tested by any other standard than that of local civism, despite the political combinations which made the careers of the three latter more nearly approach the ideal of modern statesmanship than do those of any other among the eminent publicists of Greece. Yet each and all of them sacrificed that federalism which was their professed aim to schemes of local aggrandizement and vengeance, whose accomplishment in every instance not only defeated their national efforts, but has indelibly tarnished their memories. As for Rome, it is only Prof. F. W. Newman who has in these

latter days spoken as it deserves of her treacherous, bloodthirsty, and tyrannous policy toward every foreign or allied state or tribe which seemed to so much as wish for the shadow of independence—a policy unchanged during the space of more than fifteen hundred years lying between the execution of the Samnite Pontius and the poisoning of Athanaric the Goth. The story of Boadicea is familiar enough to us here in England, thanks to Cowper's verses, but only a few scholars realize how far from exceptional it was, or how typical the spirit which found vent in the famous words *Delenda est Carthago* was of Roman patriotism, even in its best days and among its noblest examples. And consequently, when a school of teachers in the present day contrasts the passionate loyalty to the state of a Roman of the republic with the much weaker sense of civil obligations current in the ordinary European state of modern times, one is tempted to doubt whether their scholarship be equal to their enthusiasm, or whether they really know what Roman patriotism practically meant to the unfortunate Samnites, Latins, Gauls, Cantabrians, Britons, Syrians, or Mauritanians, who happened to come into collision with that side of it which regarded the extension of the *imperium Romanum*.

So very many of the popular commonplaces on patriotism are due to the influence of classical literature, that careful investigation of the actual working of that spirit in ancient times cannot fail seriously to modify opinions which have no more philosophical basis, especially as the travesty of Greek and Roman virtue exhibited during the mock classicism of the Terror cast doubts on the genuineness of even the original article, which doubts have survived to the present day. The newest reproduction of the old Greek spirit which later times have seen, is the history of the Italian commonwealths, from the beginning of the Lombard League till the final disappearance of municipal liberty in the seventeenth century, and the lessons that it reads to all who are not content to accept art instead of freedom, peace, morality, and other social bneefits, is fraught with warnings as deep as Thebes or Sparta can yield.

The Napoleonic war of aggression and conquest at the beginning of this century, and the current Russian method of annexing fresh Asiatic provinces to an already unwieldy empire, which needs internal development in population and resources far more than extension of territory, serve in like manner to reproduce with sufficient likeness for instruction the principles of Roman advance. And here, too, French or Muscovite patriotism, seen close at hand, does not seem to be so much for the advantage of mankind in general, or of any portion of mankind belonging to other races, as to compel admiration. Nor can England be acquitted altogether in seeing how patriotism, so called, has affected her dealings with foreign or dependent states. The Hundred Years' War with France in mediæval times; the manner of ruling Ireland and the American provinces in a far later era; the principles on which the New-Zealanders and the Tasmanians have been dealt with only the other day in the interest of British colonists, will none of them bear examination, even if the wholly exceptional circumstances under which our Indian Empire has grown up and is maintained take it out of the category of blame. Patriotism, then, in one very widely-accepted and popular view of it, which meets us alike in the oldest monuments of Egyptian and Assyrian conquerors in the hoary age of history, and in the editorial articles of modern newspapers, means, or at any rate involves, the deliberate sacrifice of the rights of other nations and countries to the glory of the one which claims to be patriotic, and which denounces as criminal rebellion, and chastises with fire and sword, that other patriotism which objects to be suppressed. That such a temper is entirely alien from the Christian ideas of brotherhood and justice, is doubtless true enough, but the reproach of hostile critics ought rather to be that Christianity has opposed such few and feeble barriers to conquest and aggressive wars, than that it has in any degree weakened the patriotism which is made their apology. If it could be shown that Christianity had in fact materially diminished the frequency, the area, and the fierceness of such wars, it would very considerably increase its claims on the allegiance of mankind. The consideration of the manner in which Christian belief of one kind or another has practically affected that patriotism of defense just mentioned, must be postponed to the inquiry into some other aspects of the sentiment. For it will be naturally and reasonably alleged by those who bring the charge of anti-patriotism against Christianity, that they do not in the least mean the lust of conquest and military glory, when they speak of the virtue they desire to see more widely and intelligently practised. They will urge that internal development and progress, and the steady achievement of wholesome reforms, constitute the truest aim of patriotism, and that the patriot whom they hold up for imitation is he who habitually postpones his private interests to the wel-

fare of the commonwealth, especially in that active embodiment of it which we are content to call, somewhat vaguely, the state.

It will be found, however, even under these restricted conditions, that appetite for conquest and a selfish desire to get advantages over neighbors are by no means absent, nay, that they form the most attractive part of the programme of patriotism for the majority of so-called patriots. It could hardly be otherwise, as must be seen when once the student of ethnology and of political science has mastered the facts which lie at the root of every birth of a people. There is not any instance known to history of a true nation (not even the Hebrews) having grown up in patriarchal fashion from the mere natural reproductiveness of a single family or tribe; far less of one which has been gradually and peacefully welded together by the voluntary confederation of all its original elements, without intrusion upon any separate rights during the process. In every case, the larger society has been constituted by the more or less violent absorption of smaller or weaker ones, with but little regard to their reluctance to merge their separate existence in a more powerful and numerous body—a rule which has held good from the first dawn of history down to such recent events as the War of the Sonderbund, the American civil conflict, and the struggle, scarcely eleven years ago, between Austria and Prussia for the headship of Germany. Nor can a nation be held together, after it has once been fully developed, without the suppression of a multitude of separate rights whose exercise might prove in any way inconvenient to the body politic—a familiar example of which is afforded in this country by the post office monopoly, whereby the carriage of letters is forbidden to ordinary carriers, and indeed to the general public. It is not to be expected, consequently, that patriotic feeling, which is the ordinary corporate sentiment raised to a higher degree, will at any time be tender of rights which it may think likely to conflict with the interests of its state: and till the altruistic proposition is mastered by politicians, that the welfare of each is best promoted by the welfare of all, selfish considerations, which are really hurtful by reaction, are almost certain to prevail in legislation. So far as commerce is concerned, this corporate selfishness displays itself most frequently in protective tariffs, which are not merely enacted by a country against all foreign competition, as in the United States, but actually by one colony of the same nation against other conterminous colonies, as Australia proves. No political economist can doubt for a moment the injury which erring patriotism of this kind works to the very persons whom it is intended to benefit: and, indeed, the present collapse of industry throughout the United States, which has left two millions of artisans unemployed, is almost exclusively due to the unnatural stimulus given to the mining and iron trades by high protective duties, thereby bringing very many more hands into them than a normal state of the market requires, and, of course, turning them adrift on the first reaction. It is plain that the Christian teacher and the political economist are here at one, and that the notion that a foreign country, or an adjacent colony, is not a trade rival to be repelled or outwitted, but a potential member of exactly the same fellowship, whose free admission to traffic in open market is for the advantage of the whole community, however unpatriotic it may be thought at Washington or Melbourne, is sounder in science as well as in the purely religious aspect of the matter.

Nor are the moral results of certain forms of patriotism happier than the financial ones. That temper which is called *chauvinisme* in France, "spread-eagleism" in the United States, and "John-Bullism" among ourselves, is nothing but personal vanity expanded to national dimensions, and usually manifests itself in the simultaneous refusal to learn from others, and effort to impose the opinions of the hyper-nationalists on the whole state, if not to propagate them forcibly in other countries. The revolutionary propaganda of France at the close of the last century is an example in point of the last of these manifestations, while Russia is at this moment suffering acutely from the too successful attempt of teachers of Alexander Herzen's school to make purely Muscovite ideas absolutely dominant throughout the empire, to the exclusion of all lessons which might be learned from countries with an older civilization and a more advanced political and educational system. It is, in its degree, exactly the same distrust and hate of the foreigner which semi-barbarous China displays in its comprehensive grouping of all white men under the title of *fan-kwei*, or "foreign devil." It leads, moreover, far too often to unequal and oppressive legislation against domiciled aliens, itself a policy injurious to the nation which adopts it. For the temper in question is exceedingly apt to develop into positive hatred for those whose habits and institutions differ from such as are locally usual, and the bigotry of national custom proves quite as bitter and unreasoning as any theological

fanaticism can be, barring improvement and prompting injustice. Here, too, so far as Christianity does inculcate the doctrine of a wider brotherhood than mere nationality, and strike at such patriotism as this, it is doing good service to mankind. But the truth is, that its efforts in this direction, especially among the nations which need amendment most, such as Russia and Spain, are unspeakably feeble, owing in no little measure to lack of the higher culture among religious teachers. What is perhaps even more remarkable is the intense *chauvinisme* of the only serious attempt which has been made in recent times to provide a new and improved creed to supplant Christianity. No one can attentively study the Positivist religion of humanity, as conceived and expounded by M. Auguste Comte, without recognizing through every disguise the Parisian cockney, whose one article of belief is, "Il n'y a qu'un Paris, et hors Paris il n'y a pas de salut pour les gens comme il faut." A new Paul of Tarsus, to teach the neophytes of the new creed that it is not essential for them to become Frenchmen of the boulevards in their institutions and habits of thought before they can be admitted to the Positivist equivalent for salvation, would be just as necessary as the first Paul was to rescue Christianity from the fetters of which the Judaizing faction endeavored to impose upon it. This is the more noteworthy because Positivism, by declining to consider the possibility of a future life, and therefore concentrating all moral effort on the present world, might be thought exactly the system which would promote either a lofty form of patriotism, or an uncalculating recognition of the universal brotherhood of man. But its primary condition of Frenchifying everything and everybody is clearly incompatible with either, because it is not content, as Christianity was and is, with laying down first principles, and letting the nations work them out according to their several bias and capacity. For it insists, like Islam, on providing all alike with the same ready-made code, and that with a permanent assumption of superiority for the nation where that code arose, which, to do Islam justice, it does not claim for the Arabs, since under it a negro convert is practically put on a social and religious level with the purest blooded scion of the Beni-Ismael; one reason, as Prof. Blyden has taught us, for its missionary success in Africa, as compared with the slow progress of Christianity.

It will be again urged, by the champions of the proposition combated in this paper, that all that has been said so far is still beside the question, because the patriotism for whose practice they are contending is not that national self-sufficiency which has borne so much bitter fruit. But if they choose—as they do choose for the most part—to state their objections to Christianity in a wholly unrestricted fashion, they must expect to have their costs taxed. It is not to be disputed that the faulty ideas of patriotism censured above have played, and do play, a far larger part in the history of nations than more defensible and philosophical notions have done, and it is reasonable to show that Christianity errs by defect, rather than by excess, in its resistance to such wide-spread and powerful errors, and to ask for a more precise definition of that salutary kind of patriotism which is assumed to be injuriously affected by theology.

That some kind of patriotic feeling is necessary for the very existence and security of nations, and for their healthy development, no thinker will dispute. A country whose citizens are careless of its dignity and its strength, courts and invites insult and invasion, hurtfully stimulates the lust of conquest in foreign states, and indirectly occasions the commission of great crimes against humanity, almost as guiltily as if it embarked itself into an unjust war of aggression. A country whose citizens are from habit or faction indifferent to social improvement, will lag behind in all that constitutes good government and national well-being; and the true patriot is he who will take active measures to secure for his country the blessings of honorable peace abroad, and of healthy administration at home. It may be added that he will also strive to rectify practices which militate against the honor and reputation of his country, even when they seem to make for its material interests. That little group of Englishmen who never rested till slave-holding and slave-trading were made unlawful for British citizens, were surely patriotic in a very noble fashion; and American and Spanish statesmen, who should have set themselves to resist the policy of financial repudiation, would have done far more for the honor and the true advantage of their countries than those did who caught eagerly at the temporary gains of national dishonesty. And, in like manner, the truest friends of their country will not shrink from urging the repeal of home measures, thought liberal and popular, if really hurtful to society (like the Divorce Act among ourselves), or from recommending and adopting improvements borrowed from foreign institutions, even at the risk of being denounced as unpatriotic for such eclecticism.

There is certainly nothing in the spirit of Christianity, as a moral code, which need operate against patriotism so understood and limited, for, on the one hand, its injunctions to protect the weak and oppressed are clearly applicable to nations as well as to individuals, and cover as fully the organization of an army to avert foreign tyranny and domestic suffering as they do the championship of a single widow or orphan wronged by a private oppressor; while, on the other hand, all the precepts which enjoin the doing justice impartially between man and man apply, without any strain or non-natural interpretation, to all that part of legislation and government which deals with the public and private rights of classes, persons, and things. It would be easy to show, were the digression necessary, that there are other systems, and notably Islam, under which this principle does not hold good, because all non-Moslems must be placed, in virtue of the teaching of the Koran, in a permanent state of political and social inferiority wherever Islam is the national code.

If, then, it be true that in Christian countries the operation of theological influences is to diminish the number of those citizens who are willing to busy themselves actively in the conduct of affairs, national or local, and to labor for the promotion of salutary reforms, it will be necessary to distinguish again, and to show that, just as there is a great deal of false and unwholesome patriotism, which Christianity ought to expose and resist, so it is not Christianity at large or abstractedly which withdraws men from the duties of citizenship, but merely some particular kind of adulterated and insalubrious quasi-Christian teaching, which should bear the blame alone, and not be taken as compromising and discrediting the entire Christian system.

Indeed, the whole indictment may be boldly traversed by an appeal to political experience. If it be true at all that Christianity, by directing attention to a future state, and treating this life as no more than preliminary, does necessarily weaken the practical interest of its disciples in the good government of this world, the principle must exhibit itself in action on the largest scale in national life. Exactly in proportion as an active participation in Christian belief, as distinguished from languid hereditary assent, is found prevalent among the laity, the area of political activity, and the number of those who intelligently take part in public affairs, or even in semi-public philanthropic labors, ought to be reduced. But, as a fact, the countries where the great lay body is most actively interested in religious questions, and is not content to leave them undisturbed in the custody of a professional class, are Great Britain and the United States; precisely those where the political philosopher recognizes, after all deductions, the largest measure of constitutional freedom, and the largest number of persons, not being government officials, who take a full and active share in the internal administration of local and general laws.

The hurtful abstention of the most cultured class of American citizens from the arena of politics is due altogether to social and political causes, having nothing whatever to do with religious questions; and so, conversely, the divorce of the lay intellect on the Continent from the ecclesiastical systems, whether Roman Catholic or Protestant, does not appear to have stimulated political capacity, or trained in habits of self-government the nations most affected by it. The one apparent exception, that of Italy, has been so largely conditioned by constitutional and dynastic changes in the civil sphere, that it is difficult to disentangle the strands of political and religious motive, especially from the additional complications introduced by the Roman question; but the remainder of Western Europe is quite enough to supply adequate matter of induction. Nor is it true that the publicists of those countries where Christianity is in full and active lay operation are generally or principally recruited from the ranks of secularism. It would be invidious to particularize, but no cabinet has held office in this country during the last forty years which has not contained several ministers whose interest in religious questions was active and personal, sometimes even fervid; and nothing like the Depretis Government in Italy just now has been ever possible for a moment among us. The reason why one would antecedently expect Christianity to foster patriotism in the true sense is, because it is a personal and historical creed, which, if given fair play, strengthens that sense of continuity with the past which is necessary to the higher forms of national life. Conversely, it is in countries where a mere philosophical system, like Vedantism, or an impersonal Pantheistic belief, whether Brahman or Buddhist in form, prevails, that patriotism and political history are weakest; whence it seems more than probable that there would be far less civil capacity displayed than now, if Christianity were to be superseded by Agnosticism or any non-historical belief. And this view receives strong confirmation from the definition of patriotism in time of peace,

which Goethe, the chief poet of modern Pantheism, has given us. "In peace, patriotism properly consists only in this—that each man sweeps in front of his own door, minds his own business, also learns his own lesson, that it may go well with him at home."—("Wahr. u. Dicht.") Here we may note the total absence of any sense of public duty, or of the benefit of promoting corporate reform and improvement. Pure selfishness is lifted into an ideal, and political action, as distinguished from military effort, discouraged. These considerations naturally lead to a brief retrospective survey as to the general truth of the charge of anti-patriotism laid against Christianity. This charge is a very old one indeed, and coeval with the first beginnings of the infant Church. "If we let Him thus alone, the Romans will come and take away our place and nation," was the view taken of the founder. "This man ceaseth not to speak blasphemous words against the holy place and the law, for we have heard him say that this Jesus of Nazareth shall destroy this place, and shall change the customs which Moses delivered us," was the suborned indictment against the protomartyr; while the outcry against the passionately national Saul of Tarsus was: "Men of Israel, help; this is the man that teacheth all men everywhere against the people, and the law, and this place." Under the empire, disloyalty to the state was the stock accusation which could be always successfully leveled against Christians, especially such as were in any department of the public service, and, in particular, the nucleus of solid fact which lies within the nebulous mass of Christian hagiology supplies us with many instances of Roman soldiers who had attested their loyalty and courage by valiant service in war, or who declared that prayers for the safety of the emperor and the welfare of the state made part of their daily devotions, nevertheless convicted and executed as traitors for refusing to take certain oaths, or to join in certain pagan observances. But the general charge is amply refuted by the noteworthy fact that the vast and rapidly-increasing numbers of the Christians, and their highly-organized scheme of intercommunication, never once tempted them, even under the stress of the ten persecutions, one for each generation in the three centuries from Tiberius till Constantine the Great, to try conclusions with the state by siding with any competitor for the purple, or by rebellion and league with foreign enemies on the frontier, a policy which distinguishes them remarkably from all the leading Protestant sects of the sixteenth and seventeenth centuries.

It was to Christian missionaries as statesmen that the gradual building up of the social fabric and of the system of laws was mainly due after the irruption of the barbarians, when the fortified camps of wandering tribes began to develop into the kingdoms of settled populations, and it became necessary to meet the exigencies of a more complex mode of existence by transforming indeterminate customary usages into fixed statutory enactments. To the monastic orders belongs the credit of reviving scientific agriculture, as science then was, and of leading the way in draining marshes and reclaiming wastes. To them also belongs the first attempt to supply primary education, and to stimulate higher culture, too, so far as they understood it, and the circumstances of the time allowed. Whether they did all these things well or ill is matter of reasonable debate, but that they did them somehow, and that such things are integral parts of any complete civil development, admits of no dispute. And, after this, it is not till comparatively modern times, say from the beginning of the sixteenth century, that the most eminent statesmen and publicists were other than ecclesiastics, from Alcuin and Suger, through such names as Stephen Langton, down to Ximenes and Wolsey. In fact, one of the minor grievances which precipitated the Reformation was the constant occupation of the ablest prelates in diplomacy and the conduct of civil government, obliging them to depute the spiritual oversight of their dioceses to suffragans and capitular bodies. This policy, again, may have been highly objectionable in itself, but it is at any rate quite incompatible with any recognized antagonism between Christianity and civil politics during the several centuries of its prevalence.

Turning to another aspect of the question, it is to be observed that religious sentiment has powerfully aided in supporting national life under most unfavorable circumstances.

It was Christian belief of some kind, whatever judgment may be passed upon its quality, which prevented Russia from disappearing, as a nation, under the pressure of the Golden Horde; it was the same influence which preserved Greek and Roumanian nationality during the centuries of Turkish misrule and terrorism. It is precisely the religious question that has made those Polish provinces, which have been transferred to Russia, so much more intolerant of a foreign yoke than their neighbors of Galicia and Lodomiria under Austrian rule, or of Posen under the Prussian crown, because no compulsory proselytism has

been forced on the latter. Russia, Sweden, Belgium, Great Britain itself, all witness that the rule of a foreign dynasty, to the exclusion of a native one, may be cheerfully acquiesced in, and acquire the fullest prescription; so that it is not the mere fact of being governed by strangers, mortifying as it often is to national pride, which makes one portion, and one portion only, of the Polish nation eager to assert itself, and to refuse, so far as it can, absorption into a vaster country of kindred stock. It is simply that a religious grievance has quickened their patriotism; whereas, on the hypothesis we are considering, the grievance never would have arisen, because neither the clergy nor their adherents would have interested themselves in politics so as to arouse the jealousy and the persecution of the conquering power, to which, and not to the Russian clergy, is the forcible interference with Polish religion, for political reasons, to be ascribed.

It will hardly be alleged, even by the most daring broacher of paradox, that religion had no part in rousing the Dutch patriots against Philip II.; that the interest which the Parliamentary party in our civil war took in politics was at all damped by their equally keen interest in theology; or that Cromwell's powers as a statesman and sovereign were at all chilled or hampered by his religious belief; while the same remark holds good of the most gallant leaders of the South in the American conflict—Robert E. Lee, J. E. B. Stuart, Leonidas Polk, and Stonewall Jackson. And, to return for a moment to a period between these two, it was the ecclesiastical rather than the civil acts of James II. which led to the Revolution of 1688. There is nothing in all the survey which favors the case for the prosecution; nor, if attention be directed to countries where the clerical spirit is aggressive, such as Ireland, France, and Belgium, can it be alleged, with any truth, that abstention from political action is a mark of Ultramontanism. And yet the contention seems to be not that the kind of policy followed by persons with strong religious opinions is inimical to the best interests of the state, for that would not differentiate it from mere party politics on behalf of sectional interests of any kind; but that all sense of duty toward the state, all willingness to discharge the public functions of citizenship, is fatally enfeebled by Christianity, because it diverts attention almost exclusively to a future life. Now, so far as this is true at all, it is true only of a limited number of persons under a specific kind of theological influence. The only epoch in history at which it tended to become widely true, was in the great development of monachism in Egypt and Syria (perhaps, too, in Gaul) during the fourth and fifth centuries, a period too remote and isolated to be reasonably cited in evidence now. Even the second great impetus toward monachism during the twelfth century in the West was something very different in temper and working from the passive contemplativeness of Eastern asceticism; and the leading spirit of the movement, St. Bernard, rivaled in variety and activity of exertion the most diligent secular chiefs of his time. And, when it is remembered that monachism then necessarily attracted and embraced the great majority of men with no bent toward the occupations of war, handicrafts, and agriculture, such as now would be authors, schoolmasters, professors, lawyers, physicians, scientists, and the like, it is at least doubtful whether it did not rather provide a career for those who otherwise would have had none, than withdraw them from useful service to the state and society at large. In the present day, when we have most of us got our shoulders to the wheel, but when very few of us know whither we are shoving the cart, the advantage of having a few peaceable resting-places where fuss is unknown, ought to be quite as great as it was in the stormy middle ages, not to speak of the gain to the celerity and quality of work, when there are not so many workers as to be in one another's way. As a rule, the stamp of man whom his religion seems to make unpractical, takes little save the mere color of his indolence from his creed. The indolence itself is constitutional, and his abstinence from the conduct of affairs is a gain to those who want them transacted promptly and effectively. Nevertheless, it is quite true that when all these qualifications and corrections of the original proposition have been made, there remain examples of unpatriotism and anti-patriotism for which some kind of religious sentiment appears to be accountable.

It may be fairly said, on the one hand, that the utter failure of the Reformation in France, after more encouraging beginnings than almost everywhere else, is due to the entirely anti-patriotic attitude adopted from the first by the Huguenots. Unlike those English Roman Catholics who rallied round Elizabeth Tudor when the tidings of the Armada came, and who were so ill-requited for their loyalty, the Huguenot leaders from the first made common cause with the enemies of France, and from the revolt of Guienne under Henry II. in 1548, till the Peace of Alais

under Louis XIII. in 1629, they were a constant element of national insecurity; while in particular their exploits during their brief tide of success in 1562 amply account for, though they do not excuse, the St. Bartholomew ten years later, and help to explain the slightness of the impression which their creed has produced on their nation.

It is still France which supplies the chief example of anti-patriotism, only that now the Ultramontane school, not the Huguenot, is mainly in fault. There is not only a profound consciousness that the clerical party is intriguing against the republic with every other political section by turns, because it believes that Legitimists, Bonapartists, and even Orleanists, would make larger concessions to its demands, but there is an equally deep-seated belief that the disastrous war with Prussia was mainly due to clerical pressure at the Tuileries. And though there can be no reasonable doubt that the clergy were just as infected with *chauvinisme* as the rest of France, believing in the invincibility of the army, and viewing the campaign as a mere pleasure-excursion to end triumphantly at Berlin within a few weeks, yet the conviction that they were ready to plunge the country into the cost and suffering which even the most rapid and successful war must entail on victors as well as on vanquished, and that for purely professional and sectarian objects, will not be readily laid aside. Apart from this direct charge of anti-patriotism—which is also alleged in Germany, but with far less tangible evidence, and has formed the plea for the retrograde and intolerant Falk legislation—there is the minor count of unpatriotism, contained in almost the terms of the objection to Christianity we are here considering, namely, that while the clericals themselves are superfluously active in politics, their best pupils, the very choicest of their flock, are trained into a dreamy, speculative, ascetic, and unpractical condition, which, while making them the ready dupes of every new vision, and devotees of every fresh cult, completely unfits them for the useful discharge of the ordinary duties of citizens. This indictment is strengthened by the acquiescence expressed in it by Cardinal Vitelleschi, as set forth in "Pomponio Leto." There may be a demurrer put in here with some cogency, to the effect that, even if it be so, the French clergy are merely copying the example of the state, whose principle, ever since the days of Richelieu, has been the centralization of authority, the multiplication of government officials, the discouragement of local action, and the exclusion, so far as possible, of every one, not a member of the bureaucracy, from participation in the conduct of affairs, except by voting to order at elections. It is only a question of which master is to prescribe the course of action, the hierarchy or the ministry of the interior, for the principle is the same. That is true enough, and no doubt shows that one kind of paternal government is nearly as mischievous as another is checking true patriotism, by refusing the opportunity of political education, but it leaves the charge against Christianity just where it was, merely joining another name in the indictment.

The plea, of course, is not a refutation, and indeed, so far as Ultramontanism is taken as the equivalent of Christianity, is a defiant acknowledgment of the charge. The true vindication is quite different, and may be very simply stated.

It is this: Wherever we find the unpatriotic spirit, or the anti-patriotic spirit, prevalent, and in any degree traceable to religious influence, it will be found due to a fundamental misconception of the main function of Christianity. That function, as declared again and again in the most emphatic terms in the Gospels, and somewhat less vividly, but yet with no lack of emphasis, in the Epistles, is the regeneration of society; the diminution of sin, ignorance, and suffering, particularly the first, in the world; the introduction of a new and higher moral code; the supply of fresh and vigorous principles of personal and social action; the transformation, in short, which is expressed in the Apocalypse by the words, "The kingdoms of this world are become the kingdoms of our Lord and of his Christ." Now, this process, even if advertised at the first by miracle, was carried on, so far as it has yet been carried, by intermediate agencies of an ordinary, and on the whole commonplace nature, involving much forethought and diligence on the part of those engaged in it. Wherever it has been kept steadily in view, the amelioration of mankind has gone with it, and patriotism has been reconciled with universal humanism by the common-sense principle that as a man's first social duties are to those of his own immediate household and family, then to his closest neighbors and connections, and so on in a gradually-widening circle, so the bounds of his native land are, as a general rule, the natural limits of his efforts, because differences of language, custom, and temperament, must make him less useful in a foreign country; though such instances as John Howard teach us that no hard-and-fast line of demarkation can be laid down to restrict philan-

thropic effort within national confines. A man who is interpenetrated with this view of life and duty will spend his labors chiefly on his countrymen, not because he judges them the superiors of all mankind in right of their being his own connections, far less with the notion of giving them an advantage over other nations, but because they are nearest to him, and have thus the first claim on his attention. When dogs are licking the sores of Lazarus at a rich man's door, there is a duty at hand to be attended to before sending a subscription off to a Kirghiz tribe which has had a murrain among its sheep.

But there are two entirely diverse conceptions of Christianity from that just mentioned, which, when inculcated and acted on, very naturally lead up to neglect of social duty, and that because they are both non-historical in spirit. One is that which is chiefly, but not by any means peculiarly, embodied in Calvinism—namely, that Christianity is simply a contrivance for rescuing an infinitesimal minority of human beings from endless torture, and for lodging them in abodes of unending bliss, quite apart from moral considerations, balloting them, so to speak, into a most exclusive club, and blackballing the whole remainder of mankind. This kind of opinion has not frequently, on the whole, led to its logical conclusion of Antinomian license, but it has always limited the area of real sympathy to the hypothetical elect, and very usually tended to the depreciation of such kinds of effort as imply an educational character in the present life. For example, though many very eminent scholars and theologians have been found in the ranks of its adherents, its current view has been that earthly learning is altogether superfluous for those who are destined to heavenly bliss in a life entirely disconnected from the present one, and having no relation of continuity with it whatever. In heaven we shall know, the argument runs, all that we want to know, and the wholly unlettered saint will rank along with, if not above, the most erudite; and so of all other distinctions noticeable here between man and man—wherefore the true Christian will make no account of them, nor busy himself in attaining them here, any more than a sensible youth who knew that his life was to be spent as an Indian official would devote his attention to the study of Scottish agriculture as a preparation for his new career. As to the question of sympathy, its treatment is admirably summed up in the three famous resolutions of the Pilgrim Fathers, when they were preparing to take the lands of the red-men from them by violence: "Resolved—1. That the earth is the Lord's, and the fullness thereof. 2. That the Lord hath given the earth to the saints. 3. That *we* are the saints." This principle, though rarely, if ever, expressed with such charming simplicity and directness, has yet been very generally acted on by those who accepted it, in the form of rigid intolerance when they were the ruling power, and of unscrupulous resistance to authority when subjects; of which the crowning examples are the Huguenot wars already referred to, and the invitation by the Hungarian Protestants, Tekeli and his friends, of that Turkish invasion which was crushed by the arms of King John Sobieski and of Charles of Lorraine under the walls of Vienna; in each instance all social and political considerations being postponed to those of sectarian triumph and revenge. But whatever objections may be taken on such grounds as these to the practical working of such a system, the argument we are considering can derive no support from it, for the threefold reason that the system itself, however evil its method or ends may have been at times, has by no means tended to generate political inertness and incapacity; that it never at best assumed larger dimensions than those of a single section of Christianity, whose claims, moreover, were uniformly repudiated by the enormous majority of other Christians, inclusive of the whole East, of Latin Christendom, and of Lutheranism; and that its final collapse in our own time shows that it is not identical with Christianity, which is quite unaffected, otherwise than beneficially, by its fall.

The Ultramontane form of Christianity, however, does lend more color to the objection, though the vast system of which it is at present the most powerful living exponent seems at first sight, from its wide diffusion and long continuance, free from those strait bonds of sectarianism and of mere nationalism which prove that the evil system just discussed is not, even theoretically, coextensive with the universal fellowship of Christians.

The reason why Ultramontanism has failed in all civil relations everywhere is that it has narrowed, materialized, and coarsened the idea of a kingdom of Christ, a brotherhood of ransomed humanity, by identifying it with the papal monarchy, treated all along, at any rate from the days of Nicolas I., as a temporal, much more than a spiritual domain. The consolidation and aggrandizement of this monarchy, rather than the promotion of righteousness, has been the

consistent aim of its ablest servants for several centuries; a fact curiously illustrated by the great abundance of canonists and ecclesiastical lawyers produced by the local Church of Rome, contrasted with its almost complete barrenness of theologians of respectable mark, of whom it cannot cite one for each century of its existence. But as the title-deeds of this monarchy will not stand the test of dispassionate inquiry, there has been, at any rate ever since the Counter-Reformation, a necessity for encouraging in its subjects a temper averse from criticism or resistance, but finding religious expression and content almost exclusively in docility and devoutness. No one who has given much attention to the copious stores of Roman Catholic theological literature, chiefly emotional, which have been produced, mainly by the Jesuit Society, during the last two centuries, can have failed to notice that passive obedience and pious meditation are inculcated most sedulously, as comprising the whole scheme of Christian ethics necessary for the lay mind to assimilate. And just as the Calvinist learned that the elect alone had a claim on his good-will, so the practical lesson impressed on the Roman Catholic devotee similarly restricts his sympathies to his co-religionists, visible communion with the supreme pontiff taking the same place in his conception of human fellowship as a supposed invisible communion with the heavenly Church does in the rival system.

No fair-minded person can question the sincere conviction of the majority of Ultramontane teachers, that they are, in fact, promoting righteousness in the best, and indeed only feasible way, by exalting the prerogatives of the Holy See, and laboring for clerical ascendency in every country. There may be very pertinent questions asked as to the success of the method where it was longest or most thoroughly in operation, such as France under Louis XIV., Spain and Italy, and Spanish America; but that is not the point now at issue, which is as to its bearing on patriotism. Here no favorable judgment can be pronounced, for the position of a Roman Catholic ecclesiastic in any country now, and in a less degree that of devout Roman Catholic laymen, may be compared to the view which George I. took of his position as King of England. In his mind the chief, and indeed only, value of that position to him personally, was as increasing his power as a German sovereign; and had he not been hampered by the very stringent constitutional checks due to that revolution which paved the way to his accession, there is no doubt that he would not merely have flooded the English peerage, dignities, and offices of state, with his countrymen, but have recklessly wasted the blood and treasure of his kingdom in promoting the local interests of his electorate. Now the reason why the attitude of Ultramontanes is like this, is because they are not engaged in propagating a religious creed only, nor yet an ethical code, but a great political system, claiming absolute allegiance over every aspect of civil life which casuistical ingenuity can bring under the category of either faith or morals. Theirs must, therefore, be at best a divided allegiance; and where religious feeling is strong, national welfare and philanthropic considerations will have to give way, if they seem to conflict with clerical policy and domination. Then, as regards the laity, the tendency of the neo-Roman system, despite such apparent exceptions as the Society of St. Vincent de Paul, is to exclude them not merely from an active voice in ecclesiastical affairs, but even from the subordinate task of carrying out obediently the plans of their spiritual guides, save as voters at elections and in legislative assemblies. That is to say, the tendency is to officialize everything. Schools must be conducted by members of a religious or monastic confraternity or sisterhood, such as Christian Brothers, Ursulines, and Ladies of the Sacred Heart. Almsgiving must pass through the channels of Sisters of Charity, Hospitalers, and similar institutions; and so of other like matters. No doubt this has its good side in method, economy, permanence, and general effectiveness; but it promotes, even in the domain of religion, that very inertness of the laity which amounts to unpatriotism in the sphere of civil life. In truth, the view taken of the laity under Ultramontanism is like that taken of the rank and file of an army by a government and its generals. Whatever can stimulate its enthusiasm may be adopted, but no one in authority ever dreams of giving it a voice in deciding on the justice or injustice of a quarrel, on the alternative of war and peace, or on the conduct of a campaign. So far as their members reënforce the leaders and further their aims, well and good; but purely lay and civil interests are never consulted, as the history of Bourbon Naples may sufficiently testify. And therefore it is true that, wherever this special type of religious teaching is dominant, it stunts mental power and independent thought, and does so far unfit its adherents for civil life.

But here, too, the answer is obvious, that this system has been in working order for little more

than two hundred years; has operated only over a certain area of Europe and America; has been combated with more or less success, till quite the other day, by a powerful school within the same communion; and can be shown by historical proof to be a mere unhealthy excrescence on Christianity, and no part of its essential and original constitution. Echoing the partisan watchword, "I am of Cephas," which St. Paul condemns as narrow and sectarian, it fails to grasp the idea of humanity, and is as obnoxious as the other system to the charge of treating Christianity as a mere agency for saving a few souls rather than as designed for the regeneration of the whole world, and of viewing the next life as dissociated so far from this that the cultivation of divinely-given faculties here can have no value as training for the unknown conditions of future existence: a theory which will not stand the test of deep spiritual thought.

Hence the conclusions to be drawn from a survey of the whole evidence are, that so far as Christianity is really in conflict with something called patriotism, that patriotism is not genuine and a virtue, but merely national selfishness and vanity; and so far as patriotism is in conflict with something called Christianity, that Christianity is not genuine and divine, but a misleading and sectarian gloss; while true Christianity and true patriotism harmonize perfectly, the latter being simply the local expression of the former in its relation to civil life, into which it necessarily infuses that intensity of existence, that enforcement of duty as the first requisite of morality, and that quickened interest in the welfare of others, which distinguish Christianity, not merely from the classical paganism which it supplanted, but from all later Pantheistic and Agnostic systems, and most of all from the serene selfishness of modern æsthetic Hedonism—a cult which may breed pigs for Epicurus's sty, but will never rear citizens to save a nation in time of need; or guide it wisely and bravely at any time whatever.—*Contemporary Review.*

SIR WALTER SCOTT AND HIS DOGS.

By W. C.

ONE of my pleasant recollections is that of seeing Sir Walter Scott out on a stroll with his dogs; the scene being in the neighborhood of Abbotsford, in the summer of 1824, while as yet the gloom of misfortune had not clouded the mind of the great man. There he was limping gayly along with his pet companions amid the rural scenes which he had toiled to secure and loved so dearly.

Scott's fondness for animals has perhaps never been sufficiently acknowledged. It was with him a kind of second nature, and appears to have been implanted when as a child he was sent on a visit to the house of his grandfather, Robert Scott, at Sandyknowe, in the neighborhood of Dryburgh. Here, amid flocks of sheep and lambs, talked to and fondled by shepherds and ewe-milkers, and reveling with collies, he was impressed with a degree of affectionate feeling for animals which lasted through life. At a subsequent visit to Sandyknowe, when his grandfather had passed away, and the farm operations were administered by "Uncle Thomas," he was provided with a Shetland pony to ride upon. The pony was little larger than many a Newfoundland dog. It walked freely into the house, and was regularly fed from the boy's hand. He soon learned to ride the little pony well, and often alarmed "Aunt Jenny" by cantering over the rough places in the neighborhood. Such were the beginnings of Scott's intercourse with animals. Growing up, there was something extraordinary in his attachment to his dogs, his horses, his ponies, and his cats; all of which were treated by him, each in its own sphere, as agreeable companions, and which were attached to him in return. There may have been something feudal and poetic in this kindly association with humble adherents, but there was also much of simple good-heartedness. Scott added not a little to the happiness of his existence by this genial intercourse with his domestic pets. From Lockhart's "Memoirs of Sir Walter" and other works we have occasionally bright glimpses of the great man's familiarity with his four-footed favorites. We can see that Scott did not, as is too often the case, treat them capriciously, as creatures to be made of at one time, and spoken to harshly when not

in the vein for amusement. On the contrary, they were elevated to the position of friends. They possessed rights to be respected, feelings which it would be scandalous to outrage. At all times he had a soothing word and a kind pat for every one of them. And that, surely, is the proper way to behave toward the beings who are dependent on us.

Among Sir Walter's favorite dogs we first hear of Camp, a large bull-terrier, that was taken with him when visiting the Ellises for a week at Sunninghill in 1803. Mr. and Mrs. Ellis having cordially sympathized in his fondness for this animal, Scott, at parting, promised to send one of Camp's progeny in the course of the season to Sunninghill. As an officer in a troop of yeomanry cavalry, Scott proved a good horseman, and we are led to know that he was much attached to the animal which he rode. In a letter to a friend written at this period (1803), he says: "I have, too, an hereditary attachment to the animal—not, I flatter myself, of the common jocky cast, but because I regard him as the kindest and most generous of the subordinate animals. I hardly even except the dogs; at least, they are usually so much better treated that compassion for the steed should be thrown into the scale when we weigh their comparative merits."

For several years Camp was the constant parlor-dog. He was handsome, intelligent, and fierce, but gentle as a lamb among the children. At the same time there were two greyhounds, Douglas and Percy, which were kept in the country for coursing. Scott kept one window of his study open, whatever might be the state of the weather, that Douglas and Percy might leap out and in as the fancy moved them. He always talked to Camp as if he understood what was said—and the animal certainly did understand not a little of it; in particular, it seemed as if he perfectly comprehended on all occasions that his master considered him a sensible and steady friend; the greyhounds as volatile young creatures whose freaks must be borne with.

William Laidlaw, the friend and amanuensis of Scott, mentions in the "Abbotsford Notanda" a remarkable instance of Camp's fidelity and attention. It was on the occasion of a party visiting a wild cataract in Dumfriesshire, known as the Gray Mare's Tail. There was a rocky chasm to be ascended, up which Scott made his way with difficulty, on account of his lameness. "Camp attended anxiously on his master; and when the latter came to a difficult part of the rock, Camp would jump down, look up to his master's face, then spring up, lick his master's hand and cheek, jump down again, and look upward, as if to show him the way and encourage him. We were greatly interested with the scene."

The most charming part of Scott's life was, as we think, that which he spent with his family at Ashestiel, from about 1804 to 1808, part of which time he was engaged in writing "Marmion." Ashestiel was a country mansion situated on the south bank of the Tweed, half-way between Innerleithen and Galashiels, and in what would be called a solitary mountain district. There was the river for fishing, and the hills for coursing, and no other amusement. To enliven the scene literary friends came on short visits. There was an odd character in the immediate neighborhood, called from his parsimony Old Nippie, whose habits afforded some fun. When still at Ashestiel in 1808, there is presented a pleasant picture by Lockhart of the way in which Scott passed the Sunday. The account of it is a perfect idyl. "On Sunday he never rode—at least not until his growing infirmity made his pony almost necessary for him—for it was his principle that all domestic animals have a full right to their Sabbath of rest; but, after he had read the Church service, he usually walked with his whole family, dogs included, to some favorite spot at a considerable distance from the house—most frequently the ruined tower of Elibank—and there dined with them in the open air on a basket of cold provisions, mixing his wine with the water of the brook beside which they were all grouped around him on the turf; and here, or at home, if the weather kept them from their ramble, his Sunday talk was just such a series of biblical lessons as that preserved for the permanent use of the rising generation in his 'Tales of a Grandfather.' He had his Bible, the Old Testament especially, by heart; and on these days inwove the simple pathos or sublime enthusiasm of Scripture, in whatever story he was telling, with the same picturesque richness as he did, in his week-day tales, the quaint Scotch of Pitscottie, or some rude romantic old rhyme from Barbour's 'Bruce' or Blind Harry's 'Wallace.'"

Failing from old age, Camp was taken by the family to Edinburgh, and there he died about January, 1809. He was buried in a fine moonlight night in the little garden behind the house, No. 39 Castle Street, immediately opposite the window where Scott usually sat writing. His daughter, Mrs. Lockhart, remembered "the whole family standing round the grave as her father himself smoothed down the turf above Camp with

the saddest expression of face she had ever seen in him. He had been engaged to dine abroad that day, but apologized on account of 'the death of a dear old friend.'" A few months later, Scott says in one of his letters: "I have supplied the vacancy occasioned by the death of dear old Camp with a terrier-puppy of the old shaggy Celtic breed," and which he named Wallace. This new companion was taken on an excursion to the Hebrides in 1810, and in time partly compensated for the loss of Camp. There came, however, a fresh bereavement, in 1812, in the death of the greyhound Percy. Scott alludes to the fact in one of his letters. "We are going on in the old way, only poor Percy is dead. I intend to have an old stone set up by his grave, with *Cy gist li preux Percie*" (Here lies the brave Percy); "and I hope future antiquaries will debate which hero of the house of Northumberland has left his bones in Teviotdale." The two favorite greyhounds are alluded to in the Introduction to the second canto of "Marmion:"

> "Remember'st thou my greyhounds true?
> O'er holt or hill there never flew,
> From slip or leash there never sprang,
> More fleet of foot or sure of fang."

In a letter dated Abbotsford, 1816, written to Terry, with whom he communicated on literary and dramatic subjects, he says: "I have got from my friend Glengarry the noblest dog ever seen on the Border since Johnnie Armstrong's time. He is between the wolf and deer hound, about six feet long from the tip of the nose to the tail, and high and strong in proportion: he is quite gentle and a great favorite. Tell Will. Erskine he will eat off his plate without being at the trouble to put a paw on the table or chair. I shewed him to Matthews, who dined one day in Castle Street before I came here."

The staghound so introduced was the famous Maida, which came upon the scene when the Waverley novels were beginning to set the world on fire. Maida was the crack dog of Scott's life, and figures at his feet in the well-known sculpture by Steell. He did not quite supersede Wallace and the other dogs, but assumed among them the most distinguished place, and might be called the canine major-domo of the establishment. On visiting Abbotsford in 1817, Washington Irving enjoyed the pleasure of a ramble with Scott and his dogs. His description of the scene is so amusing that we can scarcely abate a jot:

"As we sallied forth, every dog in the establishment turned out to attend us. There was the old staghound, Maida, that I have already mentioned, a noble animal; and Hamlet, the black greyhound, a wild, thoughtless youngster, not yet arrived at the years of discretion; and Finette, a beautiful setter, with soft, silken hair, long, pendent ears, and a mild eye, the parlor favorite. When in front of the house, we were joined by a superannuated greyhound, who came from the kitchen wagging his tail; and was cheered by Scott as an old friend and comrade. In our walks he would frequently pause in conversation to notice his dogs, and speak to them as if rational companions; and, indeed, there appears to be a vast deal of rationality in these faithful attendants on man, derived from their close intimacy with him. Maida deported himself with a gravity becoming his age and size, and seemed to consider himself called upon to preserve a great degree of dignity and decorum in our society. As he jogged along a little distance ahead of us, the young dogs would gambol about him, leap on his neck, worry at his ears, and endeavor to tease him into a gambol. The old dog would keep on for a long time with imperturbable solemnity, now and then seeming to rebuke the wantonness of his young companions. At length he would make a sudden turn, seize one of them, and tumble him in the dust, then giving a glance at us, as much as to say, 'You see, gentlemen, I can't help giving way to this nonsense,' would resume his gravity, and jog on as before. Scott amused himself with these peculiarities. 'I make no doubt,' said he, 'when Maida is alone with these young dogs, he throws gravity aside, and plays the boy as much as any of them; but he is ashamed to do so in our company, and seems to say: "Ha' done with your nonsense, youngsters; what will the laird and that other gentleman think of me if I give way to such foolery?"'

"Scott amused himself with the peculiarities of another of his dogs, a little shamefaced terrier, with large, glassy eyes, one of the most sensitive little bodies to insult and indignity in the world. 'If ever he whipped him,' he said, 'the little fellow would sneak off and hide himself from the light of day in a lumber-garret, whence there was no drawing him forth but by the sound of the chopping-knife, as if chopping up his victuals, when he would steal forth with humiliated and downcast look, but would skulk away again if any one regarded him.'

"While we were discussing the humors and peculiarities of our canine companions, some object provoked their spleen, and produced a sharp and petulant barking from the smaller fry; but

it was some time before Maida was sufficiently roused to ramp forward two or three bounds, and join the chorus with a deep-mouthed *bow-wow*. It was but a transient outbreak, and he returned instantly, wagging his tail, and looking up dubiously in his master's face, uncertain whether he would receive censure or applause. 'Ay, ay, old boy!' cried Scott, 'you have done wonders; you have shaken the Eildon hills with your roaring; you may now lay by your artillery for the rest of the day.—Maida,' continued he, 'is like the great gun at Constantinople; it takes so long to get it ready, that the smaller guns can fire off a dozen times first.'"

Maida accompanied his master to town, where he occupied the place of the lamented Camp. In the sanctum at Castle Street, Maida lay on the hearth-rug, ready when called on to lay his head across his master's knees, and to be caressed and fondled. On the top step of a ladder for reaching down the books from a higher shelf sat a sleek and venerable tomcat, which Scott facetiously called by the German name Hinse of Hinsfeldt. Lockhart mentions that Hinse, "no longer very locomotive, usually lay watching the proceedings of his master and Maida with an air of dignified equanimity. When Maida chose to leave the party, he signified his inclinations by beating the door with his huge paw; Scott rose and opened it for him with courteous alacrity—and then Hinse came down purring from his perch, and mounted guard by the footstool, *vice* Maida absent on furlough. Whatever discourse might be passing was broken, every now and then, by some affectionate apostrophe to these four-footed friends. Dogs and cats, like children, have some infallible tact for discovering who is, and who is not, really fond of their company; and, I venture to say, Scott was never five minutes in any room before the little pets of the family, whether dumb or lisping, had found out his kindness for all their generation."

In letters to his eldest son, Scott seldom fails to tell him how things are going on with the domesticated animals. For example: "Hamlet had an inflammatory attack, and I began to think he was going mad, after the example of his great namesake; but Willie Laidlaw bled him, and he recovered. Pussy is very well." Next letter: "Dogs all well—cat sick—supposed with eating birds in their feathers." Shortly afterward: "All here send love. Dogs and cat are well. I dare say you have heard from some other correspondent that poor Lady Wallace" (a favorite pony) "died of an inflammation after two days' illness. Trout" (a favorite pointer) "has returned here several times, poor fellow, and seems to look for you; but Henry Scott is very kind to him." In a succeeding letter we have the account of an accident to Maida: "On Sunday, Maida walked with us, and in jumping the paling at the Greentongue park contrived to hang himself up by the hind-leg. He howled at first, but seeing us making toward him, he stopped crying, and waved his tail, by way of signal, it was supposed, for assistance. He sustained no material injury, though his leg was strangely twisted into the bars, and he was nearly hanging by it. He showed great gratitude, in his way, to his deliverers."

At Abbotsford, in the autumn of 1820, when a large party, including Sir Humphry Davy, Dr. Wollaston, and Henry Mackenzie, were sallying out—Scott on his pony Sybyl Grey, with Maida gamboling about him—there was some commotion and laughter when it was discovered that a little black pig was frisking about and apparently resolved to be one of the party for the day. Scott tried to look stern, and cracked his whip at the creature, but was in a moment obliged to join in the general cheers. Poor piggy was sent home. "This pig," says Lockhart, "had taken, nobody could tell how, a most sentimental attachment to Scott, and was constantly urging his pretensions to be admitted a regular member of his *tail* along with the greyhounds and terriers; but, indeed, I remember him suffering another summer under the same sort of pertinacity on the part of an affectionate hen. I leave the explanation for philosophers—but such were the facts."

Mr. Adolphus, a visitor to Abbotsford in 1830, when the health of the great writer was breaking down under his honorable and terribly imposed taskwork, gives us not the least striking instance of Scott's wonderful considerateness toward animals. "In the morning's drive we crossed several fords, and, after the rain, they were wide and deep. A little, long, wise-looking, rough terrier, named Spice, which ran after us, had a cough, and as often as we came to a water, Spice, by the special order of his master, was let into the carriage till we had crossed. His tenderness to his brute dependents was a striking point in the benignity of his character. He seemed to consult not only their bodily welfare, but their feelings, in the human sense. He was a gentleman even to his dogs." When too roughly frolicsome, he rebuked them gently, so as not to mortify them, or spoil the natural buoyancy of their character.

We could extend these memorabilia, but have,

perhaps, said enough. Maida died in October, 1824, and is commemorated in a sculptured figure at the doorway of Abbotsford. His attached master wrote an epitaph on him in Latin, which he thus Englished:

"Beneath the sculptured form which late you wore,
Sleep soundly, Maida, at your master's door."

It was a sad pang for Scott, when quitting home to seek for health abroad, and which he did not find, to leave the pet dogs which survived Maida. His last orders were, that they should be taken care of. We may be permitted to join in the noble eulogium pronounced on Scott by Willie Laidlaw, who lived to mourn his loss, that kindness of heart was positively the reigning quality of Sir Walter's character!—*Chambers's Journal.*

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THE SOUL AND FUTURE LIFE.

By FREDERIC HARRISON.

HOW many men and women continue to give a mechanical acquiescence to the creeds, long after they have parted with all definite theology, out of mere clinging to some hope of a future life, in however dim and inarticulate a way! And how many, whose own faith is too evanescent to be put into words, profess a sovereign pity for the practical philosophy wherein there is no place for their particular yearning for a heaven to come! They imagine themselves to be, by virtue of this very yearning, beings of a superior order, and, as if they inhabited some higher zone amid the clouds, they flout sober thought as it toils in the plain below; they counsel it to drown itself in sheer despair or take to evil living; they rebuke it with some sonorous household word from the Bible or the poets—"Eat, drink, for to-morrow ye die"—"Were it not better not to be?" And they assume the question closed when they have murmured triumphantly, "Behind the veil—behind the veil."

They are right, and they are wrong: right to cling to a hope of something that shall endure beyond the grave; wrong in their rebukes to men who in a different spirit cling to this hope as earnestly as they. We too turn our thoughts to that which is behind the veil. We strive to pierce its secret with eyes, we trust, as eager and as fearless; and even it may be more patient in searching for the realities beyond the gloom. That which shall come *after* is no less solemn to us than to you. We ask you, therefore: What do you *know* of it? Tell us; we will tell you what we hope. Let us reason together in sober and precise prose. Why should this great end, staring at all of us along the vista of each human life, be forever a matter for dithyrambic hypotheses and evasive tropes? What in the language of clear sense does any one of us hope for after death: what precise kind of life, and on what grounds? It is too great a thing to be trusted to poetic ejaculations, to be made a field for Pharisaic scorn. At least be it acknowledged that a man may think of the soul and of death and of future life in ways strictly positive (that is, without ever quitting the region of evidence), and yet may make the world beyond the grave the centre to himself of moral life. He will give the spiritual life a place as high, and will dwell upon the promises of that which is after death as confidently as the believers in a celestial resurrection. And he can do this without trusting his all to a *perhaps* so vague that a spasm of doubt can wreck it, but trusting, rather, to a mass of solid knowledge, which no man of any school denies to be true so far as it goes.

I.

THERE ought to be no misunderstanding at the outset as to what we who trust in positive methods mean by the word "soul," or by the words "spiritual," "materialist," and "future life." We certainly would use that ancient and beautiful word soul, provided there be no misconception involved in its use. We assert as fully as any theologian the supreme importance of spiritual life. We agree with the theologians that there is current a great deal of real materialism, deadening to our higher feeling. And we deplore the too common indifference to the world beyond the grave. And yet we find the centre of our religion and our philosophy in man and man's earth.

To follow out this use of old words, and to

see that there is no paradox in thus using them, we must go back a little to general principles. The matter turns altogether upon habits of thought. What seems to you so shocking will often seem to us so ennobling, and what seems to us flimsy will often seem to you sublime, simply because our minds have been trained in different logical methods; and hence you will call that a beautiful truth which strikes us as nothing but a random guess. It is idle, of course, to dispute about our respective logical methods, or to pit this habit of mind in a combat with that. But we may understand each other better if we can agree to follow out the moral and religious temper, and learn that it is quite compatible with this or that mental procedure. It may teach us again that ancient truth, how much human nature there is in men; what fellowship there is in our common aspirations and moral forces; how we all live the same spiritual life; while the philosophies are but the ceaseless toil of the intellect seeking again and again to *explain* more clearly that spiritual life, and to furnish it with reasons for the faith that is in it.

This would be no place to expound or to defend the positive method of thought. The question before us is simply, if this positive method has a place in the spiritual world or has anything to say about a future beyond the grave. Suffice it that we mean by the positive method of thought (and we will now use the term in a sense not limited to the social construction of Comte) that method which would base life and conduct, as well as knowledge, upon such evidence as can be referred to logical canons of *proof*, which would place all that occupies man in a homogeneous system of *law*. On the other hand, this method turns aside from *hypotheses* not to be tested by any known logical canon familiar to science, whether the hypothesis claim support from intuition, aspiration, or general plausibility. And, again, this method turns aside from ideal standards which avow themselves to be *lawless*, which profess to transcend the field of law. We say, life and conduct shall stand for us wholly on a basis of law, and must rest entirely in that region of science (not physical but moral and social science) where we are free to use our intelligence in the methods known to us as intelligible logic, methods which the intellect can analyze. When you confront us with hypotheses, however sublime and however affecting, if they cannot be stated in terms of the rest of our knowledge, if they are disparate to that world of sequence and sensation which to us is the ultimate base of all our real knowledge, then we shake our heads and turn aside. I say, turn aside; and I do not say, dispute. We cannot *disprove* the suggestion that there are higher channels to knowledge in our aspirations or our presentiments, as there might be in our dreams by night as well as by day; we courteously salute the hypotheses, as we might love our pleasant dreams; we seek to prove no negatives. We do not pretend there are no mysteries; we do not frown on the poetic splendors of the fancy. There is a world of beauty and of pathos in the vast ether of the Unknown in which this solid ball hangs like a speck. Let all who list, who have true imagination and not mere paltering with a loose fancy—let them indulge their gift, and tell us what their soaring has unfolded. Only let us not waste life in crude dreaming, or loosen the knees of action. For life and conduct, and the great emotions which react on life and conduct, we can place nowhere but in the same sphere of knowledge, under the same canons of proof, to which we intrust all parts of our life. We will ask the same philosophy which teaches us the lessons of civilization to guide our lives as responsible men; and we go again to the same philosophy which orders our lives to explain to us the lessons of death. We crave to have the supreme hours of our existence lighted up by thoughts and motives such as we can measure beside the common acts of our daily existence, so that each hour of our life up to the grave may be linked to the life beyond the grave as one continuous whole, "bound each to each by natural piety." And so, wasting no sighs over the incommensurable possibilities of the fancy, we will march on with a firm step till we knock at the gates of death; bearing always the same human temper, in the same reasonable beliefs, and with the same earthly hopes of prolonged activity among our fellows, with which we set out gayly in the morning of life.

When we come to the problem of the human soul, we simply treat man as man, and we study him in accordance with our human experience. Man is a marvelous and complex being, we may fairly say of complexity past any hope of final analysis of ours, fearfully and wonderfully made to the point of being mysterious. But incredible progress has been won in reading this complexity, in reducing this mystery to order. Who can say that man shall ever be anything but an object of awe and of unfathomable pondering to himself? Yet he would be false to all that is great in him, if he decried what he already has achieved toward self-knowledge. Man has probed his own

corporeal and animal life, and is each day arranging it in more accurate adjustment with the immense procession of animal life around him. He has grouped the intellectual powers, he has traced to their relations the functions of mind, and ordered the laws of thought into a logic of a regular kind. He has analyzed and grouped the capacities of action, the moral faculties, the instincts and emotions. And not only is the analysis of these tolerably clear, but the associations and correlations of each with the other are fairly made manifest. At the lowest, we are all assured that every single faculty of man is capable of scientific study. Philosophy simply means, that every part of human nature acts upon a method, and does not act chaotically, inscrutably, or in mere caprice.

But then we find throughout man's knowledge of himself signs of a common type. There is organic unity in the whole. These laws of the separate functions, of body, mind, or feeling, have visible relations to each other, are inextricably woven in with each other, act and react, depend and interdepend, one on the other. There is no such thing as an isolated phenomenon, nothing *sui generis*, in our entire scrutiny of human nature. Whatever the complexities of it, there is through the whole a solidarity of a single unit. Touch the smallest fibre of the corporeal man, and in some infinitesimal way we may watch the effect in the moral man, and we may trace this effect up into the highest pinnacles of the spiritual life. On the other hand, when we rouse, chords of the most glorious ecstasy of the soul, we may see the vibration of them visibly thrilling upon the skin. The very animals about us can perceive the emotion. Suppose a martyr nerved to the last sacrifice, or a saint in the act of relieving a sufferer, the sacred passion within them is stamped in the eye, or plays about the mouth, with a connection as visible as when we see a muscle acting on a bone, or the brain affected by the supply of blood. Thus from the summit of spiritual life to the base of corporeal life, whether we pass up or down the gamut of human forces, there runs one organic correlation and sympathy of parts. Man is one, however compound. Fire his conscience, and he blushes. Check his circulation, and he thinks wildly, or thinks not at all. Impair his secretions, and moral sense is dulled, discolored, or depraved; his aspirations flag, his hope, love, faith reel. Impair them still more, and he becomes a brute. A cup of drink degrades his moral nature below that of a swine. Again, a violent emotion of pity or horror makes him vomit. A lancet will restore him from delirium to clear thought. Excess of thought will waste his sinews. Excess of muscular exercise will deaden thought. An emotion will double the strength of his muscles. And at last the prick of a needle or a grain of mineral will in an instant lay to rest forever his body and its unity, and all the spontaneous activities of intelligence, feeling, and action, with which that compound organism was charged.

These are the obvious and ancient observations about the human organism. But modern philosophy and science have carried these hints into complete explanations. By a vast accumulation of proof positive, thought at last has established a distinct correspondence between every process of thought or of feeling and some corporeal phenomenon. Even when we cannot explain the precise relation, we can show that definite correlations exist. To positive methods, every fact of thinking reveals itself as having functional relation with molecular change. Every fact of will or of feeling is in similar relation with kindred molecular facts. And all these facts, again, have some relation to each other. Hence we have established an organic correspondence in all manifestations of human life. To think implies a corresponding adjustment of molecular activity. To feel emotion implies nervous organs of feeling. To will implies vital cerebral hemispheres. Observation, reflection, memory, imagination, judgment, have all been analyzed out, till they stand forth as functions of living organs in given conditions of the organism, that is in a particular environment. The whole range of man's powers, from the finest spiritual sensibility down to a mere automatic contraction, falls into one coherent scheme: being all the multiform functions of a living organism in presence of its encircling conditions.

But, complex as it is, there is no confusion in this whole when conceived by positive methods. No rational thinker now pretends that imagination *is* simply the vibration of a particular fibre. No man can *explain* volition by purely anatomical study. While keeping in view the due relations between moral and corporeal facts, we distinguish moral from biologic facts, moral science from biology. Moral science is based upon biological science; but it is not comprised in it; it has its own special facts and its own special methods, though always in the sphere of law. Just so, the mechanism of the body is based upon mechanics, would be unintelligible but for mechanics, but could not be explained by mechanics alone, or by

anything but a complete anatomy and biology. To explain the activity of the intellect as included in the activity of the body, is as idle as to explain the activity of the body as included in the motion of solid bodies. And it is equally idle to explain the activity of the will, or the emotions, as included in the theory of the intellect. All the spheres of human life are logically separable, though they are organically interdependent. Now the combined activity of the human powers organized around the highest of them we call the soul. The combination of intellectual and moral energy which is the source of religion, we call the spiritual life. The explaining the spiritual side of life by physical instead of moral and spiritual reasoning, we call materialism.

The consensus of the human faculties, which we call the soul, comprises all sides of human nature according to one homogeneous theory. But the intuitional methods ask us to insert into the midst of this harmonious system of parts, as an underlying explanation of it, an indescribable entity; and to this hypothesis, since the days of Descartes (or possibly of Aquinas), the good old word soul has been usually restricted. How and when this entity ever got into the organism, how it abides in it, what are its relations to it, how it acts on it, why and when it goes out of it—all is mystery. We ask for some evidence of the existence of any such entity; the answer is, we must imagine it in order to explain the organism. We ask what are its methods, its laws, its affinities; we are told that it simply has none, or none knowable. We ask for some description of it, of its course of development, for some single fact about it, statable in terms of the rest of our knowledge; the reply is—mystery, absence of everything so statable or cognizable, a line of poetry, or an ejaculation. It has no place, no matter, no modes, neither evolution nor decay; it is without body, parts, or passions; a spiritual essence, incommensurable, incomparable, indescribable. Yet, with all this, it is, we are told, an entity, the most real and perfect of all entities short of the divine.

If we ask why we are to assume the existence of something of which we have certainly no direct evidence, and which is so wrapped in mystery that for practical purposes it becomes a nonentity, we are told that we need to conceive it, because a mere organism cannot act as we see the human organism act. Why not? They say there must be a *principle* within as the cause of this life. But what do we gain by supposing a "principle?" The "principle" only adds a fresh difficulty. Why should a "principle," or an entity, be more capable of possessing these marvelous human powers than the human organism? Besides, we shall have to imagine a "principle" to explain not only why a man can feel affection, but also why a dog can feel affection. If a mother cannot love her child—merely *qua* human organism—unless her love be a manifestation of an eternal soul, how can a cat love her kittens—merely *qua* feline organism—without an immaterial principle, or soul? Nay, we shall have to go on to invent a principle to account for a tree growing, or a thunder-storm roaring, and for every force of Nature. Now this very supposition was made in a way by the Greeks, and to some extent by Aquinas, the authors of the vast substructure of *anima* underlying all Nature, of which our human soul is the fragment that alone survives. One by one the steps in this series of hypothesis have faded away. Greek and mediæval philosophy imagined that every activity resulted not from the body which exhibited the activity, but from some mysterious entity inside it. If marble was hard, it had a "form" informing its hardness; if a blade of grass sprang up, it had a vegetative spirit mysteriously impelling it; if a dog obeyed his master, it had an animal spirit mysteriously controlling its organs. The mediæval physicists, as Molière reminds us, thought that opium induced sleep *quia est in eo virtus dormitiva*. Nothing was allowed to act as it did by its own force or vitality. In every explanation of science we were told to postulate an intercalary hypothesis. Of this huge mountain of figment, the notion of man's immaterial soul is the one feeble residuum.

Orthodoxy has so long been accustomed to take itself for granted, that we are apt to forget how very short a period of human history this sublimated essence has been current. From Plato to Hegel the idea has been continually taking fresh shapes. There is not a trace of it in the Bible in its present sense, and nothing in the least akin to it in the Old Testament. Till the time of Aquinas theories of a material soul, as a sort of gas, were never eliminated; and until the time of Descartes, our present ideas of the antithesis of soul and body were never clearly defined. Thus the Bible, the Fathers, and the mediæval Church, as was natural when philosophy was in a state of flux, all represented the soul in very different ways; and none of these ways were those of a modern divine. It is a curious instance of the power of words that the practical weight of the popular religion is now

hung on a metaphysical hypothesis, which itself has been in vogue for only a few centuries in the history of speculation, and which is now become to those trained in positive habits of thought a mere juggle of ideas.

We have in all this sought only to state what we mean by man's soul, and what we do not mean. But we make no attempt to prove a negative, or to demonstrate the non-existence of the supposed entity. Our purpose now is a very different one. We start out from this—that this positive mode of treating man is in this, as in other things, morally sufficient; that it leaves no voids and chasms in human life; that the moral and religious sequelæ which are sometimes assigned to its teaching have no foundation in fact. We say that, on this basis, not only have we an entrance into the spiritual realm, but that we have a firmer hold on the spiritual life than on the basis of hypothesis. On this theory, the world beyond the grave is in closer and truer relation to conduct than on the spiritualist theory. We look on man as man, not as man *plus* a heterogeneous entity. And we think that we lose nothing, but gain much thereby, in the religious as well as in the moral world. We do not deny the conceivable existence of the heterogeneous entity. But we believe that human nature is adequately equipped on human and natural grounds without this disparate nondescript.

Let us be careful to describe the method we employ as that which looks on man as man, and repudiate the various labels, such as materialist, physical, unspiritual methods, and the like, which are used as equivalent for the rational or positive method of treating man. The method of treating man as man insists, at least as much as any other method, that man has a moral, emotional, religious life, different in kind from his material and practical life, but perfectly coördinate with that physical life, and to be studied on similar scientific methods. The spiritual sympathies of man are undoubtedly the highest part of human nature; and our method condemns as loudly as any system physical explanations of spiritual life. We claim the right to use the terms "soul," "spiritual," and the like, in their natural meaning. In the same way, we think that there are theories which are justly called "materialist," that there are physical conceptions of human nature which are truly dangerous to morality, to goodness, and religion. It is sometimes thought to be a sufficient proof of the reality of this heterogeneous entity of the soul, that otherwise we must assume the most spiritual emotions of man to be a secretion of cerebral matter, and that, whatever the difficulties of conceiving the union of soul and body, it is something less difficult than the conceiving that the nerves think, or the tissues love. We repudiate such language as much as any one can, but there is another alternative. It is possible to invest with the highest dignity the spiritual life of mankind by treating it as an ultimate fact, without trying to find an explanation for it either in a perfectly unthinkable hypothesis or in an irrational and debasing physicism.

We certainly do reject, as earnestly as any school can, that which is most fairly called materialism, and we will second every word of those who cry out that civilization is in danger if the workings of the human spirit are to become questions of physiology, and if death is the end of a man, as it is the end of a sparrow. We not only assent to such protests, but we see very pressing need for making them. It is a corrupting doctrine to open a brain, and to tell us that devotion is a definite molecular change in this and that convolution of gray pulp, and that if man is the first of living animals, he passes away after a short space like the beasts that perish. And all doctrines, more or less, do tend to this, which offer physical theories as explaining moral phenomena, which deny man a spiritual in addition to a moral nature, which limit his moral life to the span of his bodily organism, and which have no place for "religion" in the proper sense of the word.

It is true that in this age, or rather in this country, we seldom hear the stupid and brutal materialism which pretends that the subtilties of thought and emotion are simply this or that agitation in some gray matter, to be ultimately expounded by the professors of gray matter. But this is hardly the danger which besets our time. The true materialism to fear is the prevailing tendency of anatomical habits of mind or specialist habits of mind to intrude into the regions of religion and philosophy. A man whose whole thoughts are absorbed in cutting up dead monkeys and live frogs has no more business to dogmatize about religion than a mere chemist to improvise a zoölogy. Biological reasoning about spiritual things is as presumptuous as the theories of an electrician about the organic facts of nervous life. We live amid a constant and growing usurpation of science in the province of philosophy; of biology in the province of sociology; of physics in that of religion. Nothing is more common than the use of the term science, when what is

meant is merely physical and physiological science, not social and moral science. The arrogant attempt to dispose of the deepest moral truths of human nature on a bare physical or physiological basis is almost enough to justify the insurrection of some impatient theologians against science itself. It is impossible not to sympathize with men who at least are defending the paramount claim of the moral laws and the religious sentiment. The solution of the dispute is, of course, that physicists and theologians have each hold of a partial truth. As the latter insist, the grand problems of man's life must be ever referred to moral and social argument; but then, as the physicists insist, this moral and social argument can only be built up on a physical and physiological foundation. The physical part of science is, indeed, merely the vestibule to social, and thence to moral science; and of science in all its forms the philosophy of religion alone holds the key. The true materialism lies in the habit of scientific specialists to neglect all philosophical and religious synthesis. It is marked by the ignoring of religion, the passing by on the other side, and shutting the eyes to the spiritual history of mankind. The spiritual traditions of mankind, a supreme philosophy of life and thought, religion in the proper sense of the word, all these have to play a larger and ever larger part in human knowledge; not as we are so often told, and so commonly is assumed, a waning and vanishing part. And it is in this field, the field which has so long been abandoned to theology, that Positivism is prepared to meet the theologians. We at any rate do not ask them to submit religion to the test of the scalpel or the electric battery. It is true that we base our theory of society and our theory of morals, and hence our religion itself, on a curriculum of physical and especially of biological science. It is true that our moral and social science is but a prolongation of these other sciences. But, then, we insist that it is not science in the narrow sense which can order our beliefs, but philosophy; not science which can solve our problems of life, but religion. And religion demands for its understanding the religious mind and the spiritual experience.

Does it seem to any one a paradox to hold such language, and yet to have nothing to say about the immaterial entity which many assume to be the *cause* behind this spiritual life? The answer is, that we occupy ourselves with this spiritual life as an ultimate fact, and, consistently with the whole of our philosophy, we decline to assign a *cause* at all. We argue, with the theologians, that it is ridiculous to go to the scalpel for an adequate account of a mother's love; but we do not think it is explained (any more than it is by the scalpel) by an hypothesis for which not only is there no shadow of evidence, but which cannot even be stated in philosophic language. We find the same absurdity in the notion that maternal love is a branch of the anatomy of the *mammæ*, and in the notion that the phenomena of lactation are produced by an immaterial entity. Both are forms of the same fallacy, that of trying to reach ultimate causes instead of studying laws. We certainly do find that maternal love and lactation have close correspondences, and that both are phenomena of certain female organisms. And we say that to talk of maternal love being exhibited by an entity which not only is not a female organism, but is not an organism at all, is to use language which to us, at least, is unintelligible.

The philosophy which treats man as man simply affirms that *man* loves, thinks, acts, not that the ganglia, or the sinuses, or any organ of man, loves and thinks and acts. The thoughts, aspirations, and impulses, are not secretions, and the science which teaches us about secretions will not teach us much about them; our thoughts, aspirations, and impulses, are faculties of a man. Now, as a man implies a body, so we say these also imply a body. And to talk to us about a bodiless being thinking and loving is simply to talk about the thoughts and feelings of nothing.

This fundamental position each one determines according to the whole bias of his intellectual and moral nature. But on the positive, as on the theological, method there is ample scope for the spiritual life, for moral responsibility, for the world beyond the grave, its hopes and its duties; which remain to us perfectly real without the unintelligible hypothesis. However much men cling to the hypothesis from old association, if they reflect, they will find that they do not use it to give them any actual knowledge about man's spiritual life; that all their methodical reasoning about the moral world is exclusively based on the phenomena of this world, and not on the phenomena of any other world. And thus the absence of the hypothesis altogether does not make the serious difference which theologians suppose.

To follow out this into particulars: Analysis of human nature shows us man with a great variety of faculties; his moral powers are just as distinguishable as his intellectual powers; and both are mentally separable from his physical powers. Moral and mental laws are reduced to something like system by moral and mental sci-

ence, with or without the theological hypothesis. The most extreme form of materialism does not dispute that moral and mental science is for logical purposes something more than physical science. So the most extreme form of spiritualism gets its mental and moral science by observation and argument from phenomena; it does not, or it does not any longer, build such science by abstract deduction from any proposition as to an immaterial entity. There have been, in ages past, attempts to do this. Plato, for instance, attempted to found, not only his mental and moral philosophy, but his general philosophy of the universe, by deduction from a mere hypothesis. He imagined immaterial entities, the ideas, of things inorganic, as much as organic. But then Plato was consistent and had the courage of his opinions. If he imagined an idea, or soul, of a man, he imagined one also for a dog, for a tree, for a statue, for a chair. He thought that a statue and a chair were what they are, by virtue of an immaterial entity which gave them form. The hypothesis did not add much to the art of statuary, or to that of the carpenter; nor, to do him justice, did Plato look for much practical result in these spheres. One form of the doctrine alone survives—that man is what he is by virtue of an immaterial entity temporarily indwelling in his body. But, though the hypothesis survives, it is in no sense any longer the basis of the science of human nature with any school. No school is now content to sit in its study and evolve its knowledge of the moral qualities of man out of abstract deductions from the conception of an immaterial entity. All, without exception, profess to get their knowledge of the moral qualities by observing the qualities which men actually do exhibit, or have exhibited. And those who are persuaded that man has, over and above his man's nature, an immaterial entity, find themselves discussing the laws of thought and of character on a common ground with those who regard man as man—i. e., who regard man's nature as capable of being referred to an homogeneous system of law. Spiritualists and materialists, however much they may differ in their explanations of moral phenomena, describe their relations in the same language, the language of law, not of illuminism.

Those, therefore, who dispense with a transcendental explanation are just as free as those who maintain it, to handle the spiritual and religious phenomena of human nature, treating them simply as phenomena. No one has ever suggested that the former philosophy is not quite as well entitled to analyze the intellectual faculties of man as the stoutest believer in the immaterial entity. It would raise a smile nowadays to hear it said that such a one must be incompetent to treat of the canons of inductive reasoning, because he was unorthodox as to the immortality of the soul. And if, notwithstanding this unorthodoxy, he is thought competent to investigate the laws of thought, why not the moral laws, the sentiments, and the emotions? As a fact, every moral faculty of man is recognized by him just as much as by any transcendentalist. He does not limit himself, any more than the theologian does, to mere morality. He is fully alive to the spiritual emotions in all their depth, purity, and beauty. He recognizes in man the yearning for a power outside his individual self which he may venerate, a love for the author of his chief good, the need for sympathy with something greater than himself. All these are positive facts which rest on observation, quite apart from any explanation of the hypothetical cause of these tendencies in man. There, at any rate, the scientific observer finds them; and he is at liberty to give them quite as high a place in his scheme of human nature as the most complete theologian. He may possibly give them a far higher place, and bind them far more truly into the entire tissue of his whole view of life, because they are built up for him on precisely the same ground of experience as all the rest of his knowledge, and have no element at all heterogeneous from the rest of life. With the language of spiritual emotion he is perfectly in unison. The spirit of devotion, of spiritual communion with an ever-present power, of sympathy and fellowship with the living world, of awe and submission toward the material world, the sense of adoration, love, resignation, mystery, are at least as potent with the one system as with the other. He can share the religious emotion of every age, and can enter into the language of every truly religious heart. For myself, I believe that this is only done on a complete as well as a real basis in the religion of humanity, but we need not confine the present argument to that ground. I venture to believe that this spirit is truly shared by all, whatever their hypothesis about the human soul, who treat these highest emotions of man's nature as facts of primary value, and who have any intelligible theory whereby these emotions can be aroused.

All positive methods of treating man of a comprehensive kind adopt to the full all that has ever been said about the dignity of man's moral

and spiritual life, and treat these phenomena as distinct from the intellectual and the physical life. These methods also recognize the unity of consciousness, the facts of conscience, the sense of identity, and the longing for perpetuation of that identity. They decline to explain these phenomena by the popular hypotheses; but they neither deny their existence, nor lessen their importance. Man, they argue, has a complex existence, made up of the phenomena of his physical organs, of his intellectual powers, of his moral faculties, crowned and harmonized ultimately by his religious sympathies—love, gratitude, veneration, submission, toward the dominant force by which he finds himself surrounded. I use words which are not limited to a particular philosophy or religion—I do not now confine my language to the philosophy or religion of Comte—for this same conception of man is common to many philosophies and many religions. It characterizes such systems as those of Spinoza or Shelley or Fichte as much as those of Confucius or Buddha. In a word, the reality and the supremacy of the spiritual life have never been carried further than by men who have departed most widely from the popular hypotheses of the immaterial entity.

Many of these men, no doubt, have indulged in hypotheses of their own quite as arbitrary as those of theology. It is characteristic of the positive thought of our age that it stands upon a firmer basis. Though not confounding the moral facts with the physical, it will never lose sight of the correspondence and censensus between all sides of human life. Led by an enormous and complete array of evidences, it associates every fact of thought or of emotion with a fact of physiology, with molecular change in the body. Without pretending to explain the first by the second, it denies that the first can be explained without the second. But with this solid basis of reality to work on, it gives their place of supremacy to the highest sensibilities of man, through the heights and depths of the spiritual life.

Nothing is more idle than a discussion about words. But when some deny the use of the word "soul" to those who mean by it this consensus, and not any immaterial entity, we may remind them that our use of the word agrees with its etymology and its history. It is the mode in which it is used in the Bible, the well-spring of our true English speech. It may, indeed, be contended that there is no instance in the Bible in which soul does mean an immaterial entity, the idea not having been familiar to any of the writers, with the doubtful exception of St. Paul. But without entering upon Biblical philology, it may be said that for one passage in the Bible in which the word "soul" can be forced to bear the meaning of immaterial entity, there are ten texts in which it cannot possibly refer to anything but breath, life, moral sense, or spiritual emotion. When the Psalmist says, "Deliver my soul from death," "Heal my soul, for I have sinned," "My soul is cast down within me," "Return unto my rest, O my soul," he means by "soul" what we mean—the conscious unity of our being culminating in its religious emotions; and until we find some English word that better expresses this idea, we shall continue to use the phraseology of David.

It is not merely that we are denied the language of religion, but we sometimes find attempts to exclude us from the thing. There are some who say that worship, spiritual life, and that exaltation of the sentiments which we call devotion, have no possible meaning unless applied to the special theology of the particular speaker. A little attention to history, a single reflection on religion as a whole, suffice to show the hollowness of this assumption. If devotion mean the surrender of self to an adored Power, there has been devotion in creeds with many gods, with one God, with no gods; if spiritual life mean the cultivation of this temper toward moral purification, there was spiritual life long before the notion of an immaterial entity inside the human being was excogitated; and as to worship, men have worshiped, with intense and overwhelming passion, all kinds of objects, organic and inorganic, material and spiritual, abstract ideas as well as visible forces. Is it implied that Confucius, and the countless millions who have followed him, had no idea of religion, as it is certain that they had none of theology; that Buddha and the Buddhists were incapable of spiritual emotion; that the Fire-worshipers and the Sun-worshipers never practised worship; that the pantheists and the humanists, from Marcus Aurelius to Fichte, had the springs of spiritual life dried up in them for want of an Old or New Testament? If this is intended, one can only wonder at the power of a self-complacent conformity to close men's eyes to the native dignity of man. Religion, and its elements in emotion—attachment, veneration, love—are as old exactly as human nature. They moved the first men, and the first women. They have found a hundred objects to inspire them, and have bowed to a great variety of powers. They were in full force long before theology was, and before the rise of Christianity; and it would

be strange indeed if they should cease with the decline of either. It is not the emotional elements of religion which fail us. For these, with the growing goodness of mankind, are gaining in purity and strength. Rather, it is the intellectual elements of religion which are conspicuously at fault. We need to-day, not the faculty of worship (that is ever fresh in the heart), but a clearer vision of the power we should worship. Nay, it is not we who are borrowing the privileges of theology: rather it is theology which seeks to appropriate to itself the most universal privilege of man.

—*Nineteenth Century.*

THE DYING OUT OF THE POLYNESIAN RACES—MAORIS AND KANAKAS.

By Sir DAVID WEDDERBURN.

IN the quarter of the globe commonly known as Polynesia the various influences, natural and artificial, which are everywhere at work, tending to diminish the variety of existing organic types and to establish a general uniformity in the aspect of Nature and of human society, appear to operate at present with peculiar rapidity. We find there the remains of a submerged continent, planed down beneath the sea-level, above which are visible only a few volcanic summits and a number of coral islets and reefs. The vast Pacific Ocean covers nearly half the earth's surface, and that portion of it called Polynesia, over which the "Many Islands" are scattered, may be styled one of the four quarters of the globe, to which in area it is approximately equal. Throughout this watery waste the only considerable tract of land is the insular group of New Zealand, exceeding somewhat in area the island of Great Britain. The next largest group is the Hawaiian, at the opposite extremity of Polynesia, containing eight inhabited islands, whose aggregate area is not much greater than that of Yorkshire. The remaining groups of Polynesia proper consist of islets so insignificant in size that the total aggregate of land in this ocean expanse is smaller than the United Kingdom of Great Britain and Ireland. All these fragments of a continent are inhabited by a kindred people; they are known generally as "Kanakas" (meaning simply "men"); but in New Zealand the natives style themselves the "Maori," or pure race, in contradistinction to the "Pakeha," or stranger. Apart from the general attractions of their character and history, a special and tragic interest attaches to these Polynesians in all their branches, for their annihilation, as a distinct race, appears to be inevitable within a very few years. Nowhere has the destructive effect even of a peaceable European invasion been so marked as in Polynesia; nowhere have the robust invaders so rapidly established themselves, to the extinction of feebler, if not inferior, breeds. The unequal nature of the struggle between the highly-organized types familiar to us here and those which have been developed under a less severe competition, is most clearly exhibited in New Zealand, whose climate resembles that of Western Europe. The fauna and flora of a small insulated land-surface have in this case been brought into direct collision with those of the great northern province, evolved as the survivors of many competing types.

The ultimate result might have been anticipated, but the rapidity with which it has been brought about is somewhat startling. In certain districts, settled a good many years ago, the native plants and animals have, with a few exceptions, already disappeared, and are replaced by those of Europe. In particular, the only conspicuous flowers and birds are those which make gay our own fields and hedge-rows, while indigenous specimens must be sought for carefully if they are to be found at all. Around Christchurch and Nelson the air rings with the song of skylarks and blackbirds, and is redolent of the scent of hawthorn and sweetbrier. A few years ago Dr. Haast, curator of the Canterbury Museum, visited a remote district in the Middle Island, where he found some three hundred different species of indigenous plants, about one-third of them being new to science. Quite recently he paid a second visit to the same district, and could only discover about ten per cent. of the species formerly seen; the rest had vanished before the face of European settlers. The only gallinaceous

bird indigenous in New Zealand is a species of quail, which was in many places very abundant a short time ago. It is now difficult to obtain a single living specimen, although the bird has undergone no severe persecution, and attempts have even been made to preserve it by an ex-premier of New Zealand. Meanwhile the Californian quail has been introduced and flourishes, and Chinese pheasants have overspread the country.

The native rat, the only terrestrial mammal found in New Zealand by European discoverers, has so completely disappeared, that many naturalists are skeptical as to its having ever existed, and the little island in Lake Taupo is said to be its only remaining habitat. On the other hand, the common brown rat, the faithful companion of the white man in all his wanderings, has taken complete possession of a country where its increase is restricted by no reptiles nor quadrupeds, and few birds of prey, and is encountered far beyond any settlements of its human fellow-colonists, close to the glaciers of the New Zealand Alps. The honey-bee of Europe has established itself as a very successful settler in the southern hemisphere, and has not merely suppressed the feeble insect rivals which it found there, but also in some parts appears to have caused a marked reduction in the number of honey-sucking birds. The destruction of timber is so universally the result of colonization, that the denudation of New Zealand is exceptional only inasmuch as an exotic vegetation is already replacing the primeval forest, which cattle and fire rather than the axe have annihilated. Near Christchurch, in the Middle Island, where extensive plantations of English trees and shrubs give to the country an aspect like that of an English midland county, there remains one small patch only of the virgin forest a few acres in extent. With the utmost care this interesting relic has been preserved by one of the earliest settlers, and, thanks to him, his younger fellow-citizens can still realize what sort of vegetation covered the Canterbury plains when he first landed in New Zealand.

Indeed, it may be said that the indigenous animals and plants of New Zealand succumb without a struggle, whether to the domesticated varieties imported by the white man for his own benefit, or to those noxious creatures and weeds of which he is the involuntary introducer. Of the human aboriginals, however, this does not hold true: in no sense are they a helpless or a feeble folk; to force they have never succumbed without a determined resistance, and they have readily adapted themselves to such peaceful changes as foreign civilization demands.

Nevertheless, the Maori race, gallant, vigorous, and intelligent, beyond any so-called savages with whom we have ever been brought into collision, seems doomed to the same fate which is overtaking the feeble, short-winged birds characteristic of the Polynesian fauna. Official statistics confirm the universal impression, among colonists and natives alike, that the Maoris are dying out. In 1849, Sir George Grey estimated their numbers at 120,000, and since then they have rapidly declined; in 1858 a native census resulted in a total of 56,000; and at the enumeration of 1874 there were 45,470 Maoris in the whole colony, all except a couple of thousand being inhabitants of the North Island. If this rate of reduction continues the "Maori difficulty" will soon solve itself, and there will be room in the North Island for many more cattle and sheep; but a brave, generous, intelligent race of men will disappear, and many, even of those who will inherit their territory, cannot regard this disappearance without regret.

When white men speak of those with dark skins whom they are subduing or supplanting, their language is not generally complimentary. It is therefore an agreeable surprise for a traveler in New Zealand to hear the tone of respect, even of admiration, in which the Maoris are habitually discussed by the colonists. Such sentiments redound indeed to the credit of both races, for they are mainly due to the military prowess of the Maoris, and prove that Englishmen bear no grudge against a gallant foe for stalwart blows taken in fair fight. Nay, our most formidable antagonists (the Sikhs, for example) appear always to enjoy a certain popularity among our countrymen, and men who themselves took part in the struggle with such chiefs as Te Raupara or Te Kooti often have a good word to say for their indomitable foes. It is at least impossible to feel contempt, and difficult not to feel admiration, for men who held their own so long against us, when every material advantage was on our side. Ten thousand British troops, supported by a large contingent of colonial volunteers besides friendly natives, and supplied with powerful artillery and arms of precision, were opposed to a few hundred Maoris armed with fowling-pieces. Notwithstanding such great odds, the contest was bloody and protracted, owing to the combined courage and judgment with which our "savage" enemies availed themselves of the natural defenses of their country, and to the

skill displayed by them in military engineering.

A Maori *pah* in peaceful times is simply an inclosure surrounded by a shallow ditch, in front of which is a light palisade interlaced with "supple-jack" vines. When prepared to stand a siege these lines of defense were strengthened, multiplied, and flanked with rifle-pits. Shot and shell passed harmlessly through the tough, elastic palisade without effecting a breach, and when troops were led to the assault they were shot down at close quarters by invisible enemies, sheltered in the ditch and firing through interstices in the palisade. If the outer line of defense became untenable, the defenders were able to take refuge behind a second inclosure, and open a murderous fire upon any assailants who might have penetrated within the first. At so short a range double-barreled smooth-bores, in the hands of cool, determined men, proved to be most effective weapons, and the usual result of assaulting a pah was discomfiture with heavy loss. Sooner or later, from want of water or ammunition, the little fortress would be evacuated by the Maoris and occupied by our troops. When this occurred after the repulse from the gate-pah, it was found that the enemy had succored the British wounded and supplied them with water, an incident well attested, but certainly not characteristic of barbarous warfare.

The Maori is, in truth, as near an approach to the ideal of a "noble savage" as has ever existed in modern times, and is a worthy rival of the imaginary Delawares of romance:

> ". . . . His valor, shown upon our crests,
> Hath taught us how to cherish such high deeds,
> Even in the bosom of our adversaries."

It would be easy to multiply authentic instances of daring and self-devotion on the part of the Maoris during the war, and difficult to give any of treachery or cowardice. Upon particular occasions they certainly were guilty of slaying non-combatants; but such acts were in accordance with their own laws of warfare, and were not regarded by them as wanton cruelty, any more than the burning of a defenseless village, or the bombardment of a city crowded with women and children, might be so regarded by certain kinds of civilized commanders. Their worst enemies have not accused them of acting like the Turks in Bulgaria, or even the Versaillais in Paris; and, on the whole, the Maoris can teach no less than they can learn as to chivalrous usages in war.

The punctiliousness with which they give due notice of an intended outbreak or attack is almost Quixotic, and tends greatly to the comfort of those settlers who live on the borders of the "Kingite" territory, a large tract extending from the west coast into the centre of the North Island. Here the natives still maintain their independence under a king of their own, and exclude the Pakehas rigorously, prohibiting the construction of roads or telegraphs. Human trespassers are warned off with polite firmness, cattle are driven back to their owners once or twice, and finally are confiscated.

When I visited a friend settled upon the Upper Waikato, a somewhat uneasy feeling was prevalent throughout that border district, owing to the construction of a railroad near the limits of the king's territory. This undertaking was regarded by the Kingites as a menace to their independence, and not without reason; for they have observed that as roads, railways, and telegraphs advance, the Pakehas increase in numbers, while the Maoris diminish, and the land passes gradually out of the hands of its original possessors. It was apprehended that despair at the prospect of this peaceful conquest of their country might cause an outbreak of the independent natives, and international relations were in a state of considerable tension in the spring (October) of 1874. My friend's house is on the very edge of the confiscation boundary; and as the farthest outlying station in that direction was completely exposed in case of an attack, I asked him, as we looked across the rushing current of the Waikato into what might at any moment become a hostile country, whether he did not feel any uneasiness at the prospect.

His reply was: "None whatever as to my personal safety, for I shall be sure to receive two or three days' warning from the Maoris, if they mean to attack us. I only wish that I could feel equally easy about the safety of my farm." He knew the natives well, and doubtless his confidence in their chivalry was not misplaced, however strange it may appear to border-men whose experience has been acquired in other lands. While wandering through the interior of the North Island, I met not a few colonists who had associated much with the Maoris, who understood their language, and had many stories to tell of their generosity and their intelligence, above all of their courage. Such stories, when told on the very scene of the events, and among the actors themselves, may be relied upon as expressing the genuine belief and tradition of the locality, even

should there be inaccuracy or exaggeration as to details.

It must be recollected that it is not a Maori, but a Pakeha, who tells the story of Orakau, where three hundred warriors displayed the spirit of Leonidas, but experienced better luck. They were surrounded by an overwhelming force of British troops, and honorable terms of capitulation were offered, but the unanimous reply came back, "We will never surrender." A desperate sortie from the pah resulted, to the astonishment of all concerned, in the escape of most of the Maoris, after cutting their way through the hostile ranks. One warrior, who carried a child in a basket strapped to his forehead, was shot dead during the fight. A comrade stooped down, coolly unfastened the basket amid a shower of bullets, and carried off the child in safety, not without a cheer from some of the soldiers who witnessed the gallant deed.

The same courage and skill which were so freely displayed against us during the Maori wars, were also found among those natives who fought on our side, and the officers of the Maori contingent had good reason to be proud of their men. Without them, indeed, peace would have been hard to establish, and a hearty union of all the native tribes might have taxed the resources of the British Empire. Fortunately for us, certain tribes have always been our zealous allies, and the colony still employs the services of a fine body, well armed and disciplined, and known as the Native Constabulary. An officer of this force described to me, with just pride, how his men, at the siege of a formidable pah, went to work with a couple of spades and a few pointed sticks, fairly sapping their way into the place, without any assistance from engineers or artillery.

When the electric telegraph was in process of construction through the centre of the North Island, near Orakeikorako, the natives, who considered that the authorities had not kept faith with them, intimated that the telegraph could not be permitted to stand, and proceeded, after due notice, to cut down the posts. These were reërected, and again cut down, after which an armed force was sent up to overawe the natives. An eye-witness described to me the interview which took place between the officer in command and the Maori envoy. On a very rainy day a naked warrior marched into the camp, and asked to see the officer commanding the troops. He was received with as great a display of force as possible, many "Queenite" natives being present; but he was equal to the occasion, and, standing alone among angry foes, he had an apt reply for every one in turn. He told the Queenites that he could estimate the exact value of their attachment to the British queen: it was just equal to a salary of six shillings a day, the amount of pay which they were then receiving. To the officer, who asserted that the authorities had always kept faith, he politely replied that such no doubt was the experience of the *rangatira* (chief or gentleman) who had just spoken, but that his own experience had hitherto been very different. In conclusion, he said: "I and my people desire no quarrel with the government, but a certain payment has been promised to us for the ground on which the telegraph stands, and we insist on that payment being made. If this is not done we will cut down the telegraph-posts, if we are attacked we will fight, and not a post shall be erected while one of us remains alive." They were paid.

It is true that the colonial government, as a rule, has treated the Maoris with remarkable fairness and consideration, but much of this has been due to their being so well able to take their own part if treated otherwise. The elements still exist in the country for one more Maori war, but there is every reason now to hope that this will be altogether averted by a just and conciliatory policy on the part of the New Zealand Government.

The "Queenite" natives, so called as being loyal subjects of Queen Victoria, in contradistinction to the adherents of the Maori king, are steadily developing into useful citizens; they cultivate the soil, pay taxes, serve in the constabulary, and take their share in public affairs as electors and as representatives.[1] Many of those who are so peaceful and law-abiding fought desperately against our troops while the war lasted. A stout foe can be a firm friend, and a conspicuous example is the gallant chief Paurini of Tokanu. No Maori enjoys more thoroughly the confidence and friendship of his white fellow-citizens, and no Maori can give a warmer welcome to a white stranger; but the stalwart figure, which his sole garment, a tartan kilt, exhibits to no small advantage, is literally riddled with the bullets of the Pakeha.

As for the "Kingites," it will not be possible for them within their limited territory to maintain much longer their present policy of isolation, and the only doubt is whether the collapse of the

[1] There are now two Maoris in the Legislative Council, and four in the House of Representatives.

little independent monarchy will come about in a peaceable or a warlike manner. Two years ago there seemed to be a risk of war, but it has not yet broken out, and the mere lapse of time is in every way favorable to peace. When in the neighborhood I was very anxious to avail myself of a missive for a Kingite chief, in order to reach, if possible, Tokangamutu, the capital village of the Maori king. After consulting a number of friends who were well informed upon the question, and one of whom had married the daughter of a great Maori chief, I resolved to abandon the attempt, as they all agreed in dissuading me, although each adviser gave different reasons for his advice. Most of them considered that the risk of personal violence was small, except, perhaps, from the Hau-hau fanatics, the rise of which sect has introduced a new element into Maori affairs. Formerly, an unarmed stranger, trusting to Maori honor, was perfectly safe in any part of the country, but now there are individuals who believe that in slaying any Pakeha they would be doing a pious deed. All were at one in saying that if I went at all I must not carry arms of any sort. The most serious objections urged were to this effect:

"Your visit, as the bearer of a letter from an ex-governor, will have an apparent political significance altogether foreign to its real object, and may produce complications. Sir George Grey's introduction will of course secure the good-will of the chief to whom it is addressed, and even of the authorities generally; but the railroad works are approaching the boundary, and matters are in a critical condition, while a number of persons in the king's country, including certain mean whites, are interested in getting up a disturbance. In particular the refugees from the Maori territory lately confiscated entertain the wild hope that in a general scrimmage they may regain their land, and feel that now or never is their chance. The king and his advisers probably do not share these feelings, but a European of any consequence runs the risk of being made the victim in some mode or other of these Adullamites, in order that the Kingites may be embroiled with the Pakehas. Under these circumstances, the better your introduction, the greater will be the risk."

The chance of seeing the last scene of independent Maori life was a great temptation, but these considerations satisfied me that I should exercise a wise discretion in letting the Kingites alone. Matters at Tokangamutu have undergone no very material change during the short interval which has elapsed since I left New Zealand, but peace has been hitherto maintained, and its future maintenance depends upon the action of the colonial government. The Maoris are able to realize more fully from day to day the utterly hopeless character of an armed struggle, and will hardly provoke one unless goaded on by a sense of oppression and injustice. On the other hand, an aggressive policy finds little favor now with the colonists, who no longer have the imperial exchequer available for war expenses, and must in future bear all such burdens upon their own shoulders. There has, in fact, been no serious Maori difficulty since the imperial troops were withdrawn from the colony.

It may be fairly assumed that the colonists will continue to act toward the Maoris with justice and moderation, as they have usually done hitherto; but even with the best intentions it is often impossible to avoid arousing a genuine sense of wrong, owing to the radical differences of law and custom between the two races, especially with regard to land. When a transfer of land from a native to a white man takes place, it is usually quite fair and straightforward according to European notions, whether by sale, by gift, or by confiscation after war. The settler performs what he believes to be all the necessary legal formalities, and pays the purchase-money agreed upon, but finds his possession of the land disputed, perhaps by an individual, perhaps by a whole tribe. The validity of the transaction is frequently denied upon the ground that the seller had no right to sell, and that tribal rights have been ignored. According to Maori usage the objections may be quite *bona fide*, and would probably receive effect from colonial judges if urged at the proper time and place. But the natives are unwilling to admit the jurisdiction of the colonial courts in such cases, and refuse to plead in them, regarding the entire legal procedure as an organization to defraud them of their land. Thus the tenure of land is here, as elsewhere, the fruitful source of discord between invaders and invaded, even when the former are desirous of acting justly according to their own ideas of justice. Meanwhile the Maoris see only too clearly that the land is passing out of their hands, and they are daily becoming fewer and feebler as their white rivals increase in numbers, in riches, and in power. The majority accept this state of matters as inevitable, and try to make the best of it, having actually in some places settled down into the position of landlords, living upon the rents paid to them by their white tenants. Within the Kingite limits, however, there are still many intractable spirits, not the least generous and

patriotic of their nation, who "long but for one battle more, the stain of their shame to efface."

Religious fanaticism stimulates this hostile spirit, and if there ever again are serious troubles with the natives in New Zealand, we shall hear more of the "Hau-haus," who have lapsed from Christianity back to their original heathenism, upon which they have engrafted some of the darker rites and tenets to be found in the pages of the Old Testament.

How far the missionaries have made any deep or lasting impression upon the life and character of the Polynesians, whom they so rapidly persuaded to accept the forms of Christianity, is a point very difficult to decide. A strong reaction from their influence and teaching has undoubtedly taken place in many parts of New Zealand, where deserted mission-stations are pointed out embowered amid choice fruit-trees, in situations the amenity of which does the highest credit to the taste of the reverend founders. In a remote village of the interior there lies on the ground a very large bell, too heavy to be swung in any building of native construction. It is the only visible token of Christianity, and bears a Maori inscription to the effect that it is a gift, bestowed in 1853 upon the believers of Tokanu by "certain good women of Kotirana," the nearest approach to the name of Scotland which the Maori alphabet permits. A good woman of the locality, on our asking what it all meant, replied with a laugh and the Maori equivalent for "soft-sawder!" The handsome gift is evidently not looked upon with the respect due to its intrinsic value, to the motives which actuated the donors, and to the difficulties overcome in conveying it into the heart of a country at that time entirely devoid of roads. During the twenty years that have elapsed since this great bell was rolled in a barrel over the fern-clad hills around Lake Taupo, many converts have either joined the Hau-haus or lapsed into utter indifference, and are pagans so far as any religious faith is concerned. But not the less on that account have the Christian missionaries deserved well of the natives. Throughout Polynesia it is entirely due to them that the natives are an educated people in the strictest sense of the word, for it is difficult to find anywhere within reach of mission influence a Polynesian, old or young, who cannot read and write.

The missionaries began by creating a written language, simple as to orthography, and invariable as to pronunciation. Having reduced to writing dialects which existed formerly as mere sounds, they ere long succeeded in converting warlike and indolent savages into lettered scholars, although many of their pupils had already attained a mature age. An achievement such as this reflects credit upon teachers and pupils alike.

It must be admitted that the missionaries have been too severe in their condemnation of native customs and amusements, and have thereby overstrained their influence. The burdens laid upon recent converts have been too heavy for them to bear, and a certain amount of reaction has necessarily followed. The "haka" and the "hula-hula" are not perhaps the most elegant or decorous of dances, but it would have been wiser to reform than to prohibit, although some Christian denominations can fairly boast of their consistent opposition to dancing of any sort, and may assert with some show of reason that waltzes and reels are not greatly superior in decorum to the native dances of Polynesia. The joyous nature of the islanders is not easily suppressed, and they are more likely to become hypocrites than ascetics; but the outburst in New Zealand of the Pai Marire or Hau-hau religion, a few years ago, proved that the stern theology of the Old Testament is not without attraction for the fiercer spirits among them. In Hawaii the awe entertained by the natives for the missionaries is enhanced by their influence with the government, which has always been considerable. Even the presence of a man-of-war "Pelekani" (British), and the popularity of the officers, will not avail to produce a "hula-hula" on Sunday in a Hawaiian village. The answer to all persuasions is, "The missionaries and the police"—the latter being in this merely the agents of the former. Where missionaries have the ear of the authorities, as in Polynesia, they need not expect to be regarded as "protectors of the poor," a title freely conceded to them in India, where many of the unconverted natives regard them as their best friends, able and willing to plead their cause even in disputes with government officials. A distinct antagonism usually exists, throughout Polynesia, between the missionary and the casual white settler, and the opinions of a stranger are apt to be colored according to the class among which he happens to be thrown. Speaking for myself, the good work of education appears to cover the other failures of the missionaries, and to compensate amply the islanders for all that they have given up, whether in land, in pecuniary contributions, or in amusement. Partly owing to a diminished population, partly also to diminished religious zeal, church accommodation is now in excess of the requirements of the natives, more

especially in Hawaii, and the staring white buildings which stud the coast are often little used, except as landmarks for vessels at sea.

In attempting to account for the depopulation of Polynesia, various causes are assigned by those who have considered the question: intemperance, immorality, infantile epidemics, and pulmonary diseases. Some persons lay stress upon one evil, some upon another, the most careful observers being the least ready with an answer. Some suggestions seem fanciful enough: the women ride too much upon horseback; wearing clothes produces susceptibility to sudden chills; and the peaceable habits of modern times cause more accessible but less healthy localities to be inhabited. Although these may all be true causes of diminished population, all combined appear inadequate to account for the result. Disease and intemperance of all sorts, combined with bad ventilation, insufficient food, and a severe climate, do not prevent the population of our large cities from increasing. Why, then, should the Polynesians succumb, whose climate is equable, whose food is abundant, and who breathe the fresh breezes from mountain and sea? They are not dispossessed of their lands or driven from their hunting-grounds like the red Indians and Australian blacks. They own large tracts of fertile soil, and foreigners are eager to pay good wages to those who will work, scarcity of labor being the main difficulty of sugar-cultivation in the Sandwich Islands. The marked deficiency of women among the Polynesians does not seem to be due to female infanticide, and is of course unfavorable to population; but they are by no means sterile, and pretty little brown children usually swarm around the native dwellings, which occur at distant intervals on the coast, or in the interior. Why, then, is it that many of these dwellings have been deserted, and that luxuriant plantations of cocoanut-palms and bread-fruit trees remain neglected? The means of subsistence are there, but those who should have gathered them have vanished. The climate and products are those of Ceylon, but where are the irrigated rice-terraces, and populous villages hidden in a jungle of fruit-bearing trees? One is reminded rather of the barren glens of Sutherland, where bright-green patches on the brown hill-sides mark the site of what are still called "towns."

Thus much is clear, however, that "civilization" has introduced into Polynesia causes of destruction more than counterbalancing the advantages of education and good government so far as the natives are concerned. They are unable, even under the most favorable conditions, to resist evils which hardly affect the vitality and fecundity of the Indo-European or Mongolian, and those vices and diseases which merely scourge the individual of the stronger race annihilate the less prolific breed.

When they are all gone there will be additional space in the world for a few Caucasians and a good many Mongolians, of whom there seem to be quite enough already, and, no doubt, the negro also would flourish and multiply in the tropical islands. On the whole, humanity will not profit greatly by the change. In frugality and industry the Kanaka is far inferior to the Chinaman, but not to the negro; while courtesy, courage, docility, and generosity, are not such common qualities that we can witness without regret the extinction of the Polynesians, who exhibit them in so marked a degree. Depopulation is not limited to Polynesia proper, but goes on all over the southern hemisphere as rapidly as in the kingdom of Hawaii, the only important insular group lying north of the equator in the Pacific Ocean. In the Feejees, since their annexation, the mortality has been appalling, but these islands are inhabited by Melanesians, a black race, very different to the brown Kanakas. The Tasmanian "black-fellow" is gone already, and his Australian brother is rapidly following him. We may pity even such irreclaimable savages as these are, and regret the mode of their extermination, but we must admit that for them there is no room within the pale of a truly civilized community, and that they are interesting only as ethnological curiosities, exhibiting in recent times a very early stage of human development. It will not take long to write their epitaph, although, in their keen love of sport and their invincible dislike of steady work, they bear a certain resemblance to some of the most exalted and highly-favored classes of mankind.

With the polished Hawaiian and the chivalrous Maori it is different, and the loss caused to humanity by their disappearance is real. Of course, they are not without failings, and contact with unworthy Europeans has not tended to diminish some of these, but they have learned, on the other hand, from our people good lessons of industry and thrift. Naturally, they have so little notion of saving as to give away, or even destroy, their surplus with reckless extravagance; but now a Maori capitalist is by no means unknown, and I have seen in the interior of Hawkes Bay and Wellington Provinces Maori farms which would do credit to any white settler.

Occasionally, however, the original nature asserts itself, and at one of these very farms the native agriculturist deliberately burned the whole of his straw because he experienced some trouble in obtaining what he considered to be its proper price. Another distinguished chief had some turkeys to dispose of, and, as the first person to whom they were offered for sale objected to the exorbitant sum asked, he gave them all away to a Pakeha friend. When the Polynesian is accused of being idle and thriftless, of having very lax notions as to female virtue, and a weakness for intoxicating liquors, the case against him has been pretty nearly summed up, and it can only be added that his failings are injurious to himself rather than to others. That those who can speak the language of Maoris or Kanakas, and who are in constant association with them, either officially or socially, like them well enough to tell many stories in their favor and few to their discredit, is a fact with which a passing traveler can hardly fail to be impressed, and my own experience, as far as it went, confirmed the favorable views of those better qualified to speak upon the subject.

A ride of a few days through a district so little frequented by Europeans that we only met one white man—a trooper of the armed constabulary—afforded an opportunity of realizing the kindly disposition and honesty of the more unsophisticated among the New-Zealanders. They could not do much for us, certainly, and one chief apologized for apparent remissness by asking, "How can I show you kindness when I have only potatoes and cabbage?" They did what they could, however, with a friendly politeness which was very gratifying. On one occasion I arrived with my guide at a Hau-hau village after dark, and found it deserted for the time being by all its inhabitants, except one very aged crone, too feeble to travel. Following the custom in such cases, we selected the most comfortable *wharé*, and made ourselves at home. This *wharé* was a hut built of reeds, fern-stalks, and native flax, closely interwoven and perfectly weather-tight. Clean mats were the only furniture, but so great was the confidence reposed by the owner in his countrymen and visitors, that he had left in this open hut his most precious possession—a pair of double-barreled guns, which had probably in their day done service against the British troops. It is illegal to sell fire-arms to the natives in New Zealand, and even a revolver and a few cartridges cannot be landed without purchasing a permit to introduce "arms, ammunition, and warlike stores," so that these two old fowling-pieces were of priceless value to the owner; yet he evidently entertained no fears for their safety. They were *tapu* (sacred), no doubt, to all good Hau-haus, and our absent host was justified in his apparent carelessness. We could make him no return for his hospitality, beyond fetching water for the poor old lady and giving her a few of our provisions. My guide was well known and popular with the natives, which insured us a welcome anywhere; but an unlucky white pedestrian who preceded us paid the penalty of the misconduct of others. Arriving at a small village, weary and foot-sore, he asked for shelter; but the men were absent, and the women did not like his looks, so one of them advised him to push on a mile or two for an imaginary settlement. There are no habitations for the next twenty-five miles, and as my experienced guide lost his way upon the trackless plain, there was some reason to apprehend that the poor "sundowner" never succeeded in making his way across. If he really did come to an untimely end, his was a hard case; but the behavior of mean whites under similar circumstances was the cause, if not the excuse, for the falsehood told by the unprotected *wahine* (woman) of Tirau. She evidently felt compunction in confessing to us this breach of hospitality, in order that we might look out for him, and the incident appeared to me at least as unfavorable to the character of white men in general as to that of this native woman in particular. Had the *rangatira* been at home, nothing of the sort would have occurred.

In Polynesia, as is usually the case where women are in a minority, they are treated with some consideration, and take part in nearly all amusements and occupations along with men. They are very fond of riding, many Maori ladies using side-saddles and riding-habits, while those of Hawaii invariably ride *à la Duchesse de Berri* on Spanish saddles; and most picturesque objects they are on horseback, in their brilliant, flowing robes, adorned with coronets and garlands of flowers. Tattooing is no longer in fashion with the youths and maidens; but in New Zealand the senior chiefs are decorated with most elaborate patterns of spirals and volutes, and the elder women have their lips and chins tattooed like the Maronites of the Lebanon. As usual among uncivilized races, the women are not so good-looking as the men, and in New Zealand they do not scorn a short clay pipe, even when dressed in complete European fashion—a practice not

calculated to improve their appearance. A good many white men have married Maori wives, and are known as "Pakeha-Maoris;" the half-breeds appear to be a fine, vigorous race.

There is an analogy between our present position in the North Island and that of the French in Algeria: the law is obeyed by all, roads and bridges are constructed, and an unarmed traveler can pass safely through the interior. The natives are treated with respect and consideration, which they have earned by their courage and good faith. No one affects to despise the Maoris any more than the Kabyles, and they enjoy, whenever they choose to claim it, complete social equality in hotels, public conveyances, and places of resort. At the same time there is, in certain districts of the island, a feeling of insecurity among the colonists similar to that which pervades Algeria, where religious fanaticism and love of independence may slumber, indeed, but are by no means dead in the hearts of the "*indigènes*."

The social position accorded to the Maoris by the whites is altogether different from that of any other dark-skinned race throughout the British dominions, but is completely justified by the readiness and ease with which they adapt themselves to the manners of good society. "Is that person a gentleman? Has he never dined with the governor before?" was the inquiry of a chief who was for the first time a guest at Government House, and observed that one of his Pakeha companions, unlike himself, was ill at ease and puzzled how to behave. A Maori member of the Legislative Council, being asked whether he had had a pleasant dinner-party, is said to have replied: "Oh, yes, very much so. We were all gentlemen; no Lower House members present." This story, however, has somewhat the appearance of having been made up at the expense of the popular branch of the Legislature.

At the opening of the Hawaiian Parliament in 1850, the king, in his address to the "nobles and representatives" of the people, assured them that the policy of the Government was "essentially protective to the Hawaiian or native race, to the intent that the question of their capability of civilization may be fully solved." For a quarter of a century the attempt to carry out such a policy has been honestly made, under singularly favorable conditions and with very encouraging results, were it not for the well-grounded apprehension that the Hawaiian race, as it becomes civilized, is doomed to become extinct. No one who has passed any time among these happy lotos-eaters can contemplate without sincere regret this consummation of so promising a political experiment. The statistics are, however, only too conclusive; and, as in the case of the Maoris, the diminution in numbers is so steady that a limit at no remote date may be calculated beyond which the Hawaiian race will not survive. Without taking into account the large estimate of the population given by Captain Cook, we find that the Sandwich Islands, in 1823, contained 142,000 inhabitants, and in 1832 only 130,000; four years later they were reduced to 108,500, and in 1849 to 80,600—their annual death-rate being then about eight per cent. In 1866 the native population was 58,765, and in 1872 (the date of the last census) 51,531, including half-castes. The excess of males over females was then no less than 3,216, and the annual decrease was estimated to be from 1,200 to 2,000. There was at the same time a small annual increase in the number of half-castes, as well as in that of the whites and Chinese.

The cause of this depopulation is certainly not political misgovernment. The independence of Hawaii has been recognized by all the great maritime nations, and the form of government is a constitutional monarchy. The Legislature is composed of twenty chiefs or nobles nominated by the crown, and a number (not exceeding forty) of representatives elected biennially. There is a considerable property qualification for representatives, and a smaller one for electors. The legislators are paid, and all sit and vote in one assembly. The king himself is of the ancient royal race, but his cabinet (composed of three ministers besides the attorney-general) contains no Hawaiian except the minister of the interior. The leading foreign merchants—one of whom has married the king's sister—are members of the Privy Council, and a preponderating influence is exercised by the enlightened white community of Honolulu. The theoretical excellence of this Constitution has not been belied by its practical working. Government schools have been everywhere established, 87 per cent. of the children of school age are actually receiving instruction, and a Hawaiian unable to read and write is rarely to be found. The sale of intoxicating liquors to natives is forbidden by law, and the legal penalties are strictly enforced. Indeed, so energetic and efficient are the magistrates, both native and foreign, that the number of criminal convictions assumes an alarming magnitude for a small community; but

it is reassuring to find that some of the offenses are not very heinous in their nature. In two years there were no less than sixty-one convictions for violating the Sabbath.

The political hardships of the Hawaiians, in fact, consist merely in being too much governed. Life and property are secure; the laws are just, and are well administered; the *quantity*, not the *quality*, of the government is in fault. The political machinery, with king, Privy Council, governors, judges, salaried ministers, and legislators, is ludicrously in excess of the requirements of the dwindling population—less than 60,000, including all the foreigners.

The military outlay, indeed, is not great, except upon music and upon gunpowder for salutes. The last item consumes a most undue proportion of the national resources, as the principal foreign powers are represented by commissioners as well as by consuls, and the tariff of guns allotted to each is two in excess of what is customary elsewhere. Men-of-war of various nations, British and American in particular, are constantly visiting Honolulu; and the islanders flatter themselves that the United Kingdom and the United States are alike prepared to use any amount of force or fraud in order to effect annexation. The various commissioners, on their side, watch one another with as much jealous distrust as do the embassadors to the Sublime Porte; each regards the success of his policy as essential to the welfare of his own country as well as that of Hawaii. At present no pretext could easily be found for foreign interference in the affairs of such a peaceable and well-conducted state, and Hawaii may hope for a season to enjoy the political independence which she owes partly to her geographical isolation, planted as she is far from any other land in the centre of the vast Pacific.

But what will be the fate of the Sandwich Islands when there are no more Hawaiians? Among foreign elements the American preponderates, especially as regards commercial interchanges, and these islands naturally gravitate toward the United States; but, oddly enough, that great maritime nation appears to despise insular possessions, even when, like St. Thomas, they constitute important mercantile entrepots. On the other hand, Great Britain, the universal annexer of islands, has once already relinquished possession of the Sandwich group, where the French and the Russian colors have also been hoisted, only to be again hauled down. It seems, therefore, as if this little archipelago were destined to remain unannexed; and, when the present royal race can no longer furnish it with a king, it may imitate its American neighbors, and proclaim the republic.

A prosperous future is before it, situated in mid-ocean between America, Asia, and Australasia, with a productive soil, and an equable climate which would be perfection did it not render all exertion alike superfluous and distasteful. At Honolulu, in 21° 18′ north latitude, and 158° west longitude, the barometer has been observed to vary during the year only from 30.24 inches to 29.70, while the range of the thermometer at the same time was between 86° and 62°, with a mean temperature of 75°. This agreeable but enervating climate prevails only at the sea-level; at a greater elevation a temperate region is found, and in the island of Hawaii the mountain-summits, rising to more than 13,000 feet, are frequently capped with snow. The windward coast of Hawaii, ever verdant and well watered, thanks to the northeast trades, is admirably described by the poet-laureate as the land of the lotos-eaters:

"A land of streams! some, like a downward smoke,
Slow-dropping veils of thinnest lawn did go;
And some through wavering lights and shadows broke,
Rolling a slumb'rous sheet of foam below.
. . . . Far off, three mountain-tops,
Three silent pinnacles of aged snow,
Stood sunset-flushed: and, dewed with showery drops,
Up-clomb the shadowy palm above the woven copse."

There is nothing melancholy about these mild-eyed lotos-eaters, except the knowledge that they will have no share in the future prosperity which white capital and Chinese labor seem likely to produce in the Sandwich Islands. During the last quarter of a century, while these "happy isles" have enjoyed such political as well as natural advantages that the population ought to have doubled itself, it has diminished by nearly one-third. The Hawaiians have proved in a most remarkable instance their appreciation of a sanitary policy, which places the welfare of the community above the prejudices and even the affections of the individual. A considerable and apparently-increasing proportion of the Hawaiians is afflicted with the terrible disease known as leprosy, which has defied all available medical science, and is regarded as absolutely incurable. How far it is contagious in the ordinary sense appears to be doubtful, for the natives have habitually neglected all precautions in associating with lepers, and yet the disease is not known to have affected above two per cent. of the population. On the other hand, it is clearly liable to be transmitted from parent to offspring, and is regarded as in-

fectious by competent authorities. To prevent all risk of infection, and to stamp out the hereditary taint, which threatened to spread through the whole community, the Hawaiian Legislature about ten years ago took up the question in a spirit at once patriotic and scientific. Under the auspices of a Board of Health a leper settlement was established in a secluded valley on the small island of Molokai, to which all persons known to be affected with leprosy were transported by officials appointed for the purpose. Considerable difficulty was experienced at first in discovering the unfortunate creatures, who were concealed by their friends, and a more painful duty could hardly be imposed upon a kindly Kanaka than to surrender a companion to pass the remainder of his days a hopeless exile in a lazaretto. But the sternness of the law did not prevent the Hawaiians from realizing its expediency, and the necessity for its strict enforcement in the interest of the public. Examples of self-devotion were not wanting on the part of persons whose external symptoms of leprosy were so slight as to escape detection, but who surrendered themselves spontaneously in obedience to the law. Nothing can well be more touching than the story told by Miss Bird, in her book on the Hawaiian Archipelago, of poor "Bill Ragsdale," whose generous self-immolation savors rather of the antique Roman than of the Kanaka. This talented half-white, who had filled among other honorable offices that of interpreter to the Hawaiian Legislature, avowed himself to be a leper before any visible symptom betrayed him, and passed amid universal lamentation from the joyous society of Hilo to a living death at Kalawao. In that dismal valley of Molokai he is now a ruler, by virtue of his abilities; but perhaps since the Odyssey was composed the well-known words have never been so applicable to any living mortal:

"Βουλο'μην κ' ἐπάρουρος ἐὼν θητευέμεν ἄλλῳ,
'Ανδρὶ παρ' ἀκλήρῳ, ὧ μὴ βίοτος πολὺς εἴη,
Ἢ πᾶσιν νεκύεσσι καταφθιμένοισιν ἀνάσσειν."

Certainly the hardest life that a slave can lead elsewhere seems preferable to that of Governor Ragsdale, who now rules with beneficent and almost absolute authority over seven hundred lepers in every stage of a lingering but fatal disease. The last effort of his eloquence, when bidding farewell to his weeping friends, was to urge submission to the stringent measures taken by the Government for the purpose of stamping out leprosy. The law for the seclusion of lepers has been enforced without distinction of rank or nationality, and in the course of eight years more than eleven hundred persons have been transported to Molokai; of these a large proportion died within a short time of their arrival, but in 1874 there remained alive more than seven hundred. Although all hope must be abandoned by those who enter Kalawao, the natural cheerfulness of the Kanakas seems not to desert them even there, and a visit from the king and queen caused no little rejoicing among the lepers. The support of these unfortunate exiles entails a heavy burden on a small community like Hawaii, with a diminishing revenue and an increasing expenditure. The burden, however, will soon be removed by the hand of death, and no item in an annual outlay of some $600,000 is less worthy of being expunged than the cost of the leper settlement. The courage and liberality displayed in grappling with this national curse are worthy of the emulation of advanced European governments.

In explanation of the disinclination to steady labor which characterizes the Polynesian, and distinguishes him in so marked a manner from the Chinese, it must be borne in mind that the islands of the Pacific are very much under-peopled, and that almost all of them lie between the tropics, and enjoy a climate in which existence is happiness and exertion is pain. As for the natives of New Zealand, whose climate may be compared to that of Italy, they are, indeed, more energetic and warlike than the gentle Kanakas of the tropical islands, but their close resemblance in character, appearance, and language, indicates a very recent separation from their northern cousins. The Maoris themselves affirm that their original home was a country named Hawaiiki, in the far north, and at Roto Iti is still exhibited an elaborately-carved canoe with fifteen benches, in which the ancestors of the Arawa tribe are said to have crossed the ocean. "Te Arawa" is the largest native craft which I saw in New Zealand, and it is about as seaworthy as a university eight-oar. On board European vessels the Maoris prove themselves to be bold and skillful seamen, but in naval architecture they are inferior even to the black islanders of Melanesia. The seas around New Zealand are swept by gales very different from the soft trade-winds of the tropical Pacific, and the transport of provisions and water sufficient for a long voyage in a canoe across these seas seems to be an impossibility. On the map the islands of Polynesia appear to be thickly sprinkled, but in reality they are so few and so small as to occupy a space almost inappreciable

upon the immense expanse of water. Most of them are coral islets, which are raised so little above the sea-surface as to be invisible at a short distance. During a voyage of three weeks through the heart of the galaxy we only sighted two coral islets, and a lofty volcanic island in the Navigators' group. It may be said that the Pacific is an area of subsidence, and at a period geologically recent the land-surface must have been very much larger than it now is, but all evidence seems to indicate that the Maoris have colonized New Zealand at a period which is *recent* in a very different sense of the word. Eminent naturalists are even of opinion that the moa, a bird whose feathers are still found in perfect preservation, and whose remains are imbedded in the newest alluvial deposits, was extinct before the arrival of the Maoris. They hardly succeeded in explaining, however, what agency, except that of man, could have destroyed a creature so powerful and so abundant, in a country without beasts of prey, and where no important geological change has occurred since the time when it flourished.

How and when the Maoris reached New Zealand will in all probability never be accurately determined, but their tropical origin is clear enough. They have never really peopled the South (or Middle) Island, the largest and most productive of the group, but have lingered in the balmy climate of the north, and have planted many of their most important settlements around the numerous hot springs of the volcanic districts. Thanks to these natural supplies of heat, they can dispense almost entirely with fuel, and in some villages the inhabitants, like those of a fashionable spa, spend a considerable portion of the twenty-four hours in bathing. From long habit they enjoy a temperature which would almost scald a European, and will tumble heels over head into natural caldrons apparently at the boiling-point, and into which I could not bear to dip my hand. At sunset, the whole population of a village, men, women, and children, may be seen disporting themselves in the tepid depths, or seated, with the water up to their necks, on the smooth enameled sides of these natural thermæ. Infants in arms bathe along with the rest, learning to swim before they are able to walk, and perched on the shoulders of their tattooed grandfathers, they regard with astonished black eyes the bleached Pakeha, whose bloodless appearance contrasts most unfavorably with the wholesome brown of the Maori. Laughing, talking, floundering, and splashing, the natives do not forget their good manners, and are as polite in the water as they are upon land, treating a stranger with marked consideration. It is needless to say that they are perfect swimmers, the women no less than the men; in the popular Maori legend it is Hero, not Leander, who performs the feat of swimming over to the island of Mokoia. In a country of lakes and rivers, where the only canoes are long, cranky "dug-outs," fashioned of a wood almost equal in specific gravity to water, and propelled with short, feeble paddles, it is necessary to be a good swimmer. When two or three miles from the shore, with a stiff head breeze rendering it necessary that half the crew should use their paddles for baling, you know that your native companions, encumbered only with a light kilt, will probably reach the land in safety if the canoe is swamped or upset. This knowledge, however, affords only a modified degree of comfort to a Pakeha, clad probably in water-proof and riding-boots, and rouses his wrath against conservatism displayed by the Maoris in boat-building. Occasionally fatal accidents occur even to natives, and not long ago two canoes full of people were swamped in Lake Rotorua: two women only were saved, the men behaving with great self-devotion in endeavoring to assist the weaker and more helpless.

Even now, when steamers ply regularly between Auckland and Honolulu, there is little or no intercourse between the Polynesians of the southern temperature and the northern tropical latitudes; and it is astonishing, after passing over so many thousand miles of sea, to find one's self among people who in features and complexion, in frank and courteous bearing, and even in such small details as their mode of decoration with flowers or feathers, seem to be identical with those that one has quitted. It is, however, in language that the substantial identity shows itself most distinctly, as, after allowing for certain differences of pronunciation, it will be found that almost all the words in common use are the same in the Maori and Kanaka dialects. These are precisely the words which could not have been recently borrowed by one dialect from the other; and as neither possessed until quite recently any literature, or even an alphabet, it is remarkable that so very little divergence should have taken place.

Great as are the charms of scenery and climate—

"Where the golden Pacific round islands of paradise rolls—"

the chief interest and romance of these regions are due to their aboriginal inhabitants, and will

pass away with them. A country newly occupied by white settlers is neither romantic nor picturesque when the primeval forest has been reduced to charred stumps, and a long interval must elapse before the undefaced glories of the wilderness can be replaced by the cultivated beauty of an old and prosperous land. In time the fern-land and bush of New Zealand will be converted into a populous and productive country; but the people and the products will be English, and not Maori. Thus the world becomes more prosperous and wealthy, but less interesting and varied, and the inducements to travel diminish as the facilities increase. Even in older countries the variety of scenery, of architecture, of costume, of social and political institutions, of fauna and flora, so charming at the present moment, is tending to become a thing of the past, and will be vainly sought for by the travelers of another generation. An Eastern dragoman once said to me, while we were gazing in admiration at a crumbling Saracenic edifice, "We see these things, but our sons will not be able to see them." The feeling to which his words gave expression was constantly in my mind when among the Maoris and Kanakas, whose "tenakoe" and "aloha," their friendly greetings to the passing stanger, have all the pathos of an eternal adieu.—*Fortnightly Review.*

BEER, AND THE TEMPERANCE PROBLEM.

By CHARLES GRAHAM.

THE magnitude of the consumption of beer and spirits by our laboring-classes, and the great and certainly not diminishing abuse of these alcoholic stimulants, combine to render the subject of the following article one of deep interest to all anxious to combat a wide-spread and increasing source of injury to the public welfare. Though the majority of the nation is opposed to the views of Sir Wilfrid Lawson and others of his school, yet all must feel deeply concerned at contemplating the vast sums of money spent by the nation on beer and spirits, and the great amount of misery and crime caused by the excessive use of these beverages. The records of our criminal courts, the oft-expressed statements of our judges and magistrates, the opinions of medical authorities, indeed the experience of all, testify to this great and growing evil.

Hence the efforts, for many years past, of those who would, if they could, prohibit the use of all alcoholic beverages so as to get rid of the evils arising from the abuse of them. Our recent legislation, though conceived in a spirit contrary to the views of the Alliance party, has yet assumed that the evil might be lessened by limiting the number of public-houses; a process ineffectual for the purpose of reducing the consumption, and fraught with danger, because it is building up a gigantic monopoly, which year by year will root itself deeper, until at last its abrogation by the substitution of a better system will cost the nation many millions in compensation to the trade. The supporters of the Liverpool experiment may at least claim for it the merit of being in accord with free-trade principles, and that under such a system it would be impossible for a vast monopoly to grow up to bar the way to future legislation.

All attempts, however, to reduce or to abolish the consumption of the so-called intoxicating beverages, whether conceived in the spirit of Mr. Chamberlain's enthusiastic attempt to introduce a modification of the Göthenburg system, or in that of the Permissive Bill party, are based on insufficient knowledge not only of the articles consumed but also of the consumers. They cannot, or will not, distinguish between *good* and *bad* products; nor between use and abuse—indeed, they hold the one to be the necessary consequence of the other; and, lastly, they utterly ignore, with the willful blindness common to the holders of extreme views, the chief cause of the excessive consumption of alcoholic liquids.

Hence their efforts are doomed, in the future as in the past, to failure; or, if they are apparently successful, as in Maine, secret and illicit drinking, with all its vices of law-breaking, deceit, and hypocrisy, will replace the present drinking system, which, bad though it be, has at least the merits of being open and legal.

Though opposed to all such propositions as being an unjustifiable interference with the liberty of the subject, and as being utterly worthless as a remedy for the disease, one must yet

give the compulsory abstinence party, as well as those who are not prepared to go so far in limiting our liberty, the credit at least of good intentions. Their object has been good, though the means advocated for securing it have been bad. It is not by such drastic treatment that the average Englishman is to be cured of his abuse of alcoholic drinks, but by offering him a better and a pleasanter place of social meeting than a public-house bar; by allowing him the right and privilege which the rich man enjoys at his club—the right to drink alcoholic or other beverages or not, as it suits him, and the privilege of social intercourse without being compelled to drink to excess solely for the benefit of the house; and by securing to him *good beer*.

I propose, in the first place, to describe briefly the manufacture of beer, and to point out some of the shortcomings of the English process and the injurious influence of our obstructive fiscal system in retarding improvement, especially in the direction of a cheaper and less intoxicating beer; and having seen how *good* beer, whether of the English alcoholic character or of the German less alcoholic and more dextrinous character, is produced, I will venture to suggest a means whereby the working-man may be led, without interfering with his liberty of action, to the temperate use of them.

Before describing the process of manufacture, it will not be without interest to quote some statistics on the development of the trade, given in a recent publication on brewing and distilling.[1] In 1873, excluding malt exported or used in distilleries, no less than 59,174,089 bushels of malt were manufactured into beer, producing a revenue of £8,027,408 in the form of malt-tax. In the year ending March, 1873, there were 144,425 dealers and retailers of beer in the United Kingdom. Thus much regarding the magnitude of the beer-trade. As regards spirits, we find that 30,644,750 gallons of spirits were made during the year ending March 31, 1875, and the revenue derived from this source amounted to £14,895,769. Allowing for a small portion used in the arts, there were retained for consumption as a beverage 29,821,574 gallons; or about one gallon for each man, woman, and child, in the United Kingdom. The number of licenses granted in the same year to persons dealing in and retailing spirits was 138,845. In round numbers we see that beer yields some £8,000,000, and spirits some £15,000,000 to the revenue; the two together, if we include the revenue derived from the licenses to brewers, distillers, and dealers, may be put down as being about £24,000,000. This of course does not include the revenue derived from the wine and spirits imported; these, however, concern rich men rather than poor, who rarely drink wine or brandy of foreign manufacture.

Let us now briefly examine the process of manufacture, the first stage of which consists in converting barley into malt.

Ground barley, wheat, or any other cereal, when infused with warm water, slowly undergoes a change by which the insoluble starch in the grain is gradually converted into soluble sugars or allied substances. The activity of the albuminoid ferments in ground grain is, however, too slow for the brewers' purpose, and hence recourse is had to the process of malting.—i. e., germination of the grain—which converts some of the inert albuminoid bodies into active agents of change, grouped under the general term *diastase*.

With this view the maltster steeps the grain in water for a period of about fifty hours, varying, however, according to the time of year and the kind of barley employed. So soon as the grain has absorbed a sufficiency of water to carry on the subsequent germination, it is removed from the cistern, and is spread on the floor of the malt-house. Oxygen is absorbed, the temperature rises, and germination commences, and is allowed to proceed until a sufficient development of the young plumule has been obtained, the growth of the plumule being coincident with the swelling noticed at the back and under the testa. This secured, the grain is then dried on the floor of a kiln heated by a fire beneath. This process stops all further development, and produces empyreumatic products, so important to the flavor and keeping qualities of the beer. When dry, the malt is then fit for the brewer's or distiller's use. The malt thus made is then crushed between rollers and mixed in the mash-tun—the vessel wherein the infusion process is conducted—with about twice its weight of water, the proportion varying with the method of infusion adopted and the strength of the beer to be produced, the temperature of the water being such that after the intermixture the contents of the mash-tun range from 63° C. to 67° C. In the mashing or infusion process which now commences, the diastase is the agent by which water is absorbed, and dextrine and various sugars—the hydration products of the reaction—are obtained. The infusion product of the English

[1] "British Manufacturing Industries," Stanford, 1876.

brewer's process is rich in sugars and allied bodies, readily convertible into alcohol and carbonic acid in the subsequent process of fermentation. Though the English brewer is permitted by law to use cane-sugar, and sugar made from maize, rice, or other starch-yielding materials, he is yet forbidden the use of unmalted grain, whether highly dried on the kiln or not, and is therefore unable to employ materials yielding a greater proportion of dextrine than he can obtain from malt. It is true that the law allows the conversion of raw grain into dextrine, dextrine-maltose, and grape-sugar, but the brewer is forbidden such latitude of manufacture, and, as the chief expense of the process consists in evaporating the dilute saccharine liquid so as to render it solid, it follows that the brewer in purchasing such starch-sugars, and in again dissolving them in water is put to a great and wasteful expenditure in undoing what the excise laws have caused to be done.

The brewers of England must associate themselves together in order to obtain the repeal of the present antiquated laws regulating the details of manufacture, and in place of a tax on malt they should propose that the tax should be levied on the *weight* of saccharine or amylaceous materials employed in the tun. Thus free to use the materials at their command to the best advantage, they would be enabled to employ, in conjunction with malt, barleys which are unfit for the malting process. These could readily be converted by simple chemical means into dextrine-sugars or into glucose, or by simple torrefaction into dextrine, as in the process for preparing British gum. By such an alteration in the law not only would the farmer benefit, by being able to grow barley on heavy land, but also by being enabled to produce malt for his cattle—a benefit, however, which I am bound to acknowledge to be problematical. The great gainer, however, would be the working-man, inasmuch as he would obtain a cheaper and more dextrinous ale.

The German brewer is allowed to use unmalted grain, and is thus enabled to prepare a more dextrinous beer. The chief method employed in Germany to obtain such dextrinous beer is, however, by the system of mashing. The Bavarian brewer mixes malt and water at a temperature of 37° C., and allows the infusion process to go on for a short time. A portion of the solid and liquid contents of the tun is then pumped into the boiler, where the mixture, not unlike gruel, is boiled for half an hour, after which it is run back into the tun, the temperature of the whole mash being thereby raised to about 50° C. After a time another thick mash (*Dickmaisch*) is drawn off and boiled, and again run into the tun, the temperature of the contents being now raised to 60° C. The next process is to draw off a thin mash (*Lautermaisch*), which is boiled and replaced in the mash-tun, the temperature of the whole contents of which is thereby raised to 75° C. Without pursuing this interesting technical process further, and without noticing the various modifications followed in Bavaria, in Bohemia, and in North Germany, it will suffice to state that by this method of boiling a portion of the malt some of the diastase is destroyed as a ferment at each repetition of the process, and hence the final product is richer in dextrine-sugars than the corresponding product of the English infusion system. This method of obtaining a highly-dextrinous infusion was invented by the Bavarians long ago, and consequently before our present chemical knowledge was at the brewer's command. It is needlessly laborious and expensive, nor are the dextrine-sugars obtained of so stable a character as may be produced by methods based on our existing scientific knowledge; the application of which knowledge, however, is forbidden to the English brewer.

Reverting to the English brewery, let us follow the remaining stages of the manufacture of beer. The infusion process being finished, the wort—as the liquid containing the infusion products of the malt is termed—is then drawn off from the insoluble residue, or grains, and boiled in another vessel with hops, the quantity of this valuable agent of preservation depending on the character of the ale, and on the length of time it is to be kept before consumption. Simple boiling produces the coagulation of some of the albuminous matters, a further portion being precipitated by the tannin of the hops. The boiled wort is afterward cooled and placed in the fermenting vessels, and yeast added. The English brewer commences the fermentation at a temperature varying from 14° C. to 18° C., and as the decomposition of the sugar by the yeast organism is attended with the production of heat, the temperature rises rapidly unless precautions be taken to prevent this. Some English brewers allow the temperature to rise to 25° C., and even higher, with great gain so far as rapidity of production is concerned, but to the serious loss of flavor, soundness, and *wholesomeness*, of the product. Now, high and rapid fermentation not merely produces an inferior product as regards

flavor, but it favors the formation of the poisonous alcohols grouped together under the general term of *fusel-oils*. The distiller produces even more of these poisonous alcohols, because he uses large quantities of raw grain with his malt, and as he desires to convert as much as possible of the original starch into alcohol, he makes thin infusions, and employs a high temperature in the fermentation process. He sacrifices delicacy of flavor and wholesomeness for the gain of more alcohol; and though he attempts by fractional distillation and other means to eliminate the poisonous alcohols—the fusel-oils—he only partially succeeds in his object; hence, unless submitted to the slow oxidation of years through the pores of the cask, the unfortunate consumer suffers for the improper fermentation employed.

It is beside our present purpose to pursue the remaining technical operations of *cleansing* and *racking*, but we will assume that the final product is in the hands of the consumer. It may be one of England's best products, a dry alcoholic beer, or it may be a badly-fermented beer; in all cases, however, it is rather to be considered an article to be consumed with food than as a summer beverage, or as a pleasant, slightly exhilarating stimulus to conversation.

Having seen how the Bavarian prepares his wort, let us examine the method of fermentation. Instead of cooling the wort, after the boiling process with hops, down to the ordinary temperature of the atmosphere, or such a temperature as cold water will produce, as is general in England, he refrigerates it by the aid of ice to a temperature of 5° C. or 6° C., and by the liberal employment of ice he succeeds in producing a very slow fermentation, throughout which he never permits the temperature to rise above 8° C. The yeast sinks to the bottom in place of rising to the top, as in the English process, and some twelve to sixteen days, and even more, elapse before the first stage of the fermentation process is completed. The beer is then removed from the fermenting-vessel and placed in store-vessels, wherein during weeks and months the fermentation slowly continues until the beer is required for consumption. Throughout this long period of secondary fermentation the beer is kept below 8° C. by being surrounded by large masses of ice; in the larger breweries many thousand tons being employed to effect the object in view. The process for preparing lager, or store beer, is therefore expensive, not merely in consequence of the masses of ice consumed, but also on account of the slowness of the fermentation, which necessitates a greater amount of room and of vessels employed.

Though this be so, yet the very dextrinous character of the beer enables the Bavarian brewer to be very liberal in the use of water, without producing thinness, and hence, while the manufacturing process is more expensive than that pursued in England, beer is cheaper in Germany than with us.

It will be seen from this brief exposition of the methods followed by the English and Bavarian brewers respectively that the essential points of difference are that the German aims at obtaining infusion products rich in dextrine, so as to secure a substance which does not readily undergo alcoholic fermentation, and which therefore remains in the beer, giving a fullness in the mouth not attained by English ales having the same original gravity—or strength—of the wort. The Bavarian beer is consequently less alcoholic and less intoxicating; indeed, it requires much industry on the part of the German beer-drinker to get beyond the stage of pleasant animation; and, as a matter of fact, the German workman runs no risk of intoxication so long as he refrains from drinking the poisonous rye-schnapps. This dextrinous and less alcoholic character of the foreign product is, moreover, not the only advantage which it possesses over English ales: owing to the low temperature employed and the necessarily slow progress of the fermentation, there is produced but little of those poisonous alcohols already referred to. In England, as before stated, some English brewers employ rapid fermentation, and all, or nearly all, distillers use still higher temperatures. This it is which causes the crude and bad spirits sold throughout England and Germany to be so intoxicating in their effects. Thus our ill-fed workman, who consumes some bad beer and finishes with still worse spirits, even though the actual amount of alcohol taken be not great, becomes intoxicated—poisoned, indeed—and is maddened, to the danger of those around him; or becomes utterly stupid, until roused next day with fever, a parched skin, and a racking brain. Knowing that the amount consumed was vastly incommensurate with the evil effect produced, he maintains that the beer and spirits were drugged. In some cases he may be right, yet in many the publican may be innocent of having contravened the Adulteration of Food and Drugs Act beyond the addition of common water, and in some instances of a little molasses. The act takes no note of injurious substances produced by ignorance or by neglect in the manu-

facture of any article, though the effect is the same as if such had been added; the magistrate therefore punishes the accused, even though he may have reason to think that there is some truth in his statement.

It becomes, then, not only desirable to produce a dextrinous and slightly alcoholic ale for conversation purposes, but it is equally to be desired that the brewer in the English process should commence his fermentation at 13° C. to 14° C., and should avoid allowing the temperature during the process to rise above 20° C. to 21° C. Such temperatures are already employed by many English brewers, whose particular trade may require that the beer shall keep sound for weeks in the cellar of the middle or upper class consumer, or be capable of exportation abroad. Much of the beer consumed by the working-classes is, however, not so carefully prepared, and may, before they consume it, have been manipulated by the greed of the publican. Though it is desirable that Bavarian beer should be brewed in England, steam-power being employed to produce the necessary low temperature, we need not require that our brewers generally should follow the process employed abroad. As a stimulant, or with food, the carefully-prepared alcoholic Burton ales, and those of similar character, are unsurpassed. All we need require is, that the same careful attention given to low temperature in their production shall be given to the manufacture of a more dextrinous and less alcoholic ale.

Leaving the consideration of the manufacture, it will be admitted by all, except the Alliance party, that good beer and good spirits are less injurious than bad products when consumed largely; yet even these, when taken in excess, not only waste the poor man's earnings, but also produce injurious effects, moral and physical. The question here naturally presents itself: *To what is excessive drinking due?* I care not to discuss the extreme views and dogmatic assertions of the advocates of total abstinence, nor the remedy proposed by them, since they are equally outside of all practical discussion and legislation; but inasmuch as we find that the German or the Frenchman is able to take beer or wine in moderation without becoming a drunkard, and as every one's experience in our own country substantially confirms this—even though there be sad exceptions—we must seek for some explanation other than that so confidently presented to us by the earnest and well-meaning haters of moderation.

The answer to our question may doubtless be partly found in the statement often made by medical authorities, that the strain produced by monotonous labor and anxiety on the brain is such, that stimulants are resorted to in order to obtain momentary forgetfulness. This explanation, though in some cases true, is yet greatly inadequate to account for the wide-spread and general use and abuse of alcoholic stimulants. The French or German workman is equally liable to distress, equally the subject of monotonous mechanical toil. Again, difference of race and of climate helps us but little to solve the problem before us. These and other supposed causes—especially bad air, bad water, and bad lodging—have some basis of truth in them, but they are vastly inadequate as a sufficient explanation. We must seek elsewhere for the chief cause, and this we shall find in comparing the respective features of a public-house in a large town in England, and a restaurant-café or Bierkeller or Biergarten abroad. In the former the guest must generally stand at a bar—the exigencies of the trade having gradually abolished the miserable accommodation of a narrow bench, which formerly was conceded to the customer—and he has to drink without being distracted by the games which are played in a similar house of public entertainment abroad. Of late years *parlors* have been given up because they do not pay; and thus the working-men can no longer get the accommodation of a fire to cook their food at, and utensils to consume it. In short, an English public-house, especially of late years in large towns, is usually arranged solely for drinking-purposes, the beverages being too often limited to bad beer and worse spirits. Abroad, on the contrary, one finds a pleasant room, with tables at which to sit, furnished with newspapers, and games of cards and dominoes and other amusements going on; and not only alcoholic beverages, but coffee and other non-alcoholic drinks, with simple and inexpensive food of various kinds, are being served.

Our excessive drinking is, I maintain, chiefly due to the universal desire of conversation and social intercourse, only obtained in England under unfavorable conditions, and under influences which lead to the consumption of bad spirits. The rich man asks a friend whom he desires to see either to meet him at home, or, if that be inconvenient, at his club. For the working-man, generally, it is impossible to meet his friend at his home, consisting, as it but too often does, of one or it may be two rooms; and in the evening it is especially inconvenient to his wife and children. Often, indeed, the home is of such a kind that he not only cannot ask a friend to call on

him there, but is even too glad to go elsewhere himself. That elsewhere is not like the rich man's club, where he can order or not what he likes; but an English public-house, arranged exclusively for drinking beer and spirits, and where, in consequence of the monopoly price paid for the good-will by the tenant, drinking immoderately and rapidly is the understood and enforced rule.

Hence the working-man is driven to drink more than he ought; and, once under the influence of a slight excess, it too often happens that he continues until he is more or less intoxicated. So long as he is quiet and attentive to the interest of the house, the publican plies him with more of his baneful wares, until he is too noisy or too stupid to drink more; he is then put outside the door, if need be with the policeman's aid. It is true that some men go to a public-house in order to get drunk, and they would be ill satisfied if a moderate quantity of beer and of spirits failed to produce the desired effect. These men, however, form fortunately but a very small proportion of those who frequent public-houses because they have no other place of social meeting. The great mass of our working-classes, who chiefly use our public-houses, go there for conversation and social intercourse, and for business purposes connected with their various benefit and trade societies, without having any intention or desire to overstep the limits of moderation. Such views are not in accordance with the desires of the publican, whose sole aim, as I have said, is to recoup himself rapidly for the heavy payment too often made for the business. I maintain, then, that a very natural desire for social intercourse and amusement, coupled with the fact, sadly too common, that these are not always to be had at home, is the chief cause for the general use of public-houses. Once there, the workman must either continue to drink, and that not too slowly, or then he is made to understand that if he requires no more he had better make room for others. Now, it is a notorious fact that, in our large towns, even the rudest sitting accommodation is being refused, since drinking goes on faster and more profitably when the customers are kept standing around a bar.

Working-men's clubs, as established in some towns by well-meaning philanthropists, are no doubt of some use, especially to those who are members of the Good Templars' Society; in such clubs beer and spirits are forbidden, and books and papers of a fitting kind are carefully selected by the earnest clergyman or committee who manage the club. Such attempts, however, cannot reach the masses; the average English workman is very much like the average member of the middle or upper classes, and equally opposed to having his social intercourse and relaxation managed on goody principles. It may be sad to think that a working-man prefers beer to soda-water, the *Weekly Dispatch* to the *British Workman;* but in this he resembles those who are richer: and those who desire to succeed in reaching and benefiting the masses must take other measures than by offering them entertainment based on the assumption that working-men are but children, who will be content with sugar-and-water and *good* books. The true remedy to overcome the too great consumption of alcoholic liquids is to place within the working-man's reach a place of public entertainment such as a workman in a French or German town can go to. In a German town, for example, the workman finds a pleasant room wherein to meet his fellows and others somewhat above him in the social scale. Here he sits and amuses himself for one, two, or even three hours with conversation, newspapers, and games, and consumes his two or three *Schoppen* of beer, costing some fourpence. He can also obtain a simple supper of sausage or cheese and bread at a cost of twopence or threepence. The French workman finds similar cheap places of entertainment; in the centre and south of France the cheap wines of the district being substituted for beer. Every one who has lived or traveled much abroad knows the small amount of money spent even in a three hours' sitting by the frequenters of such places. The landlord's interest even there is, of course, to sell as much as possible; to him, however, it is a matter of indifference whether it be coffee or beer, and as he pays but little for the good-will—I am not now describing a fashionable *café* in Paris—he can afford to allow his customers to sit without compelling them to drink rapidly for the benefit of his trade. I would urge with some confidence—derived from several years' residence abroad, and from a considerable experience of the working-classes there and at home—upon our statesmen, our magistrates, our philanthropists, and indeed upon all who desire to benefit the poorer classes in our own country, the advantages which would in time be derived from the establishment of places of public entertainment based on aims other than those of the gin-palace. Permissive legislation has already in many important instances been adopted, and to this principle, for example, we are indebted for the efforts now being made by many municipal bodies to improve the dwellings of the poor. Better lodging, bet-

ter air, and better water will, no doubt, aid much in improving the health of the poorer classes, and even aid in making them more temperate; yet the good such improvements will effect in regard to excessive drinking will be slight unless the necessity be recognized of placing within the reach of the working-man good and wholesome drink, and a place of social meeting other than a modern gin-palace, with its too often badly-fermented alcoholic beer, and its still worse rank and poisonous spirits.

I venture, then, to propose that the Legislature should empower local bodies to open one or more of these *cafés* or places of public entertainment, where the working-man should have all the advantages enjoyed by the rich man at his club, the same freedom to order what he wishes, and the same right to remain there without ordering anything. It may, and doubtless will, be objected that such places would never pay, because the profit derived from the small consumption would be insufficient to pay a moderate interest on the capital and the expenses of management. Those who entertain such fears I think might dismiss them were they to remember that the profit on drink is very great, and to realize the great difficulty there would be for some time to impress upon the working-classes that they could remain there for even two or three hours without being repeatedly incited by the habits formed by their experience of public-houses to order more and more drink. But even were the total abstainers' millennium to arise suddenly, and the working-classes generally to abjure alcohol in all its forms, there would still be ample profit on non-alcoholic substitutes. Others may fear that many would avail themselves of the accommodation of well-ventilated and well-lit rooms, and of the advantages of reading newspapers and periodicals, without payment in one shape or another; but this dread may readily be dismissed since admission might be given by the purchase of a twopenny ticket, which should include not only the use of the establishment, but also two-pennyworth of the food and drink sold there. It may be objected, and doubtless will be by many not interested in the liquor-traffic, that such a scheme would be a gross and unjustifiable interference with established interests and with freedom of trade. It does not concern me here to discuss this argument, further than to suggest, in reply, that society has often, and will yet often, interfere in such matters. Nor am I concerned to discuss fully another charge which will doubtless be made, that I am proposing to convert local bodies into dealers in food and drink. I frankly admit, however, that were all such places of public entertainment in the hands of municipal and other local authorities, grave inconveniences and even more serious consequences would, doubtless, arise socially and politically.

I only suggest the establishment of one or more, according to the population, in order to show working-men the advantage of this system over the existing one. Public enterprise would gradually convert the present public-houses and gin-palaces into working-men's *cafés* or clubs, the publicans themselves aiding in the change if the success of the system justified it.

In small towns the association of a few philanthropists would suffice to establish one such place of entertainment; in larger towns two or three such might be established, and they would be the more readily assisted by the licensing magistrates if a spirit-license were not required. This mode of action would certainly cause no injury to the political morality of local authorities; and had I enough confidence in the sufficiency of philanthropic enterprise, I would be content to trust the scheme altogether to such action. Mere philanthropic effort is, however, too slow to fight rapidly and effectually with the widespread evil, to combat which the scheme is suggested; the Peabody and other similar efforts to secure to the working-classes better lodging, though valuable as experiments, are yet vastly inferior in efficiency and rapidity to the beneficial powers given to corporations under Mr. Cross's act. The powers conferred by it are tentative and limited as to time; so might it, with great advantage, be the case in the proposed effort to stem the evil influences of the gin-palace.

Regarding the profits derived from the sale of food and drink, they will necessarily be small compared with those of public-houses; but it must not be forgotten that these latter are now, owing to the increasing monopoly, at exorbitant prices compared with houses of similar size. We must remember that there would be no good-will to pay for, and hence the capital required would be comparatively small. Well conducted, they would probably pay at least five per cent. on the capital invested, after the management expenses had been paid, and this even were the articles of food and drink sold as cheaply as in France or Germany. It would not, however, be advisable to sell under the usual trade-price, so as to avoid the antagonistic feelings which would arise among those already engaged in the trade. Greater excellence in the articles sold, and vastly superior

accommodation, should be the guiding principles, rather than cheapness. Still, in spite of the better entertainment, there would be in most cases a profit left after the five per cent. on the capital had been paid. The poor-rate, or other local rate, should benefit by all such extra profit, not only in the case of such places of meeting being established by local authorities, but even when established by philanthropic action.

In conclusion, while giving due weight to the causes assigned on various sides to account for the large consumption of alcohol in our country, I yet maintain that the natural desire of man to meet his fellow, and the fact that this can only be done by the working-man in a public-house or gin-palace established solely for the rapid consumption of beer and spirits, are the chief causes; and that the true remedy is to put within the reach of the poorer classes a place of social meeting where good and simple food, and drink, non-alcoholic as well as alcoholic, shall be sold to him, and where he will not be compelled to overstep the bounds of moderation any more than the rich man in his club.

Though not essential to the scheme, it will yet be wise to urge upon the Treasury the advantage of greater freedom in the manufacture of beer, so that the more enterprising of our brewers may be enabled to produce a more dextrinous and less alcoholic beverage than is now made—to brew a *conversation-beer*, rather than a highly-stimulating one, for purposes of social meeting. The managers of such places should not only take care that the articles sold should be the best of their kind, but should also discourage the consumption of spirits even when good, so far as they can without improper interference with the liberty of the customer. This is not all: it will be well to encourage the presence of the whole family; an occasional evening in such *cafés* or clubs will relieve the dreary monotony of the dull and too often wretched home. Such meetings, joined to the necessity that soon would be felt that all must be presentable in their dress and attentive to their persons, would go no small way to improve the lower portion of the working-classes. Abroad, the fact that the working-man must wash off the dust of the day's toil before going to such places, is of itself no unimportant aid to his general improvement.

There remains yet one more important use such places could be put to. At present in most cases the benefit-clubs and trade-societies of the working-classes hold their meetings in public-houses because they have no other choice, and because they are tempted by the apparent liberality of the publican. The members of such clubs are not only subject to the bad influences of the place, but must drink for the benefit of the landlord. Those who are best acquainted with the working-classes know well the serious evil that attends such meetings in public-houses; the amount paid into the benefit society being too often but a trifle compared with that consumed in drink. The upper rooms in the *café* should therefore be devoted to such purposes, a charge being made for the accommodation, which could either be made for an hour, or a month, or a year, and without the pernicious system of being compelled to drink for the benefit of the house.

Thus, not by the intolerant propositions of the Alliance party, nor by the costly and, I fear, strife-causing means of Mr. Chamberlain, but by the simple and safe influences of example to the working-classes and to the publicans, we may hope in time to see our poorer classes as moderate in their drinking-habits as their fellows in Germany and France when meeting together in the evening. Though we shall not make all sober, we can yet remove the cause of insobriety in so many—the *compulsion to drink*. Time and better influences must be left to do the rest.—*Contemporary Review.*

THE MYSTERY OF THE PYRAMIDS.

By RICHARD A. PROCTOR.

FEW subjects of inquiry have proved more perplexing than the question of the purpose for which the pyramids of Egypt were built. Even in the remotest ages of which we have historical record, nothing seems to have been known certainly on this point. For some reason or other, the builders of the pyramids concealed the object of these structures, and this so successfully that not even a tradition has reached us which purports to have been handed down from the

epoch of the pyramids' construction. We find, indeed, some explanations given by the earliest historians; but they were professedly only hypothetical, like those advanced in more recent times. Including ancient and modern theories, we find a wide range of choice. Some have thought that these buildings were associated with the religion of the early Egyptians; others have suggested that they were tombs; others, that they combined the purposes of tombs and temples; that they were astronomical observatories; defenses against the sands of the Great Desert; granaries like those made under Joseph's direction; places of resort during excessive overflows of the Nile; and many other uses have been suggested for them. But none of these ideas are found on close examination to be tenable as representing the sole purpose of the pyramids, and few of them have strong claims to be regarded as presenting even a chief object of these remarkable structures. The significant and perplexing history of the three oldest pyramids—the Great Pyramid of Cheops, Shofo, or Suphis, the pyramid of Chephren, and the pyramid of Mycerinus—and the most remarkable of all the facts known respecting the pyramids generally, viz.,. the circumstance that one pyramid after another was built as though each had become useless soon after it was finished, are left entirely unexplained by all the theories above mentioned, save one only, the tomb theory, and that does not afford by any means a satisfactory explanation of the circumstances.

I propose to give here a brief account of some of the most suggestive facts known respecting the pyramids, and, after considering the difficulties which beset the theories heretofore advanced, to indicate a theory (new, so far as I know) which seems to me to correspond better with the facts than any heretofore advanced; I suggest it, however, rather for consideration than because I regard it as very convincingly supported by the evidence. In fact, to advance any theory at present with confident assurance of its correctness would be simply to indicate a very limited acquaintance with the difficulties surrounding the subject.

Let us first consider a few of the more striking facts recorded by history or tradition, noting, as we proceed, whatever ideas they may suggest as to the intended character of these structures.

It is hardly necessary to say, perhaps, that the history of the Great Pyramid is of paramount importance in this inquiry. Whatever purpose pyramids were originally intended to subserve, must have been conceived by the builders of *that* pyramid. Few ideas may have been superadded by the builders of later pyramids, but it is unlikely that the original purpose can have been entirely abandoned. Some great purpose there was, which the rulers of ancient Egypt proposed to fulfill by building very massive pyramidal structures on a particular plan. It is by inquiring into the history of the first and most massive of these structures, and by examining its construction, that we shall have the best chance of finding out what that great purpose was.

According to Herodotus, the kings who built the pyramids reigned not more than twenty-eight centuries ago; but there can be little doubt that Herodotus misunderstood the Egyptian priests from whom he derived his information, and that the real antiquity of the Pyramid-kings was far greater. He tells us that, according to the Egyptian priests, "Cheops on ascending the throne plunged into all manner of wickedness. He closed the temples, and forbade the Egyptians to offer sacrifice, compelling them instead to labor one and all in his service; viz., in building the Great Pyramid." Still following his interpretation of the Egyptian account, we learn that 100,000 men were employed for twenty years in building the Great Pyramid, and that ten years were occupied in constructing a causeway by which to convey the stones to the place and in conveying them there. "Cheops reigned fifty years; and was succeeded by his brother Chephren, who imitated the conduct of his predecessor, built a a pyramid—but smaller than his brother's—and reigned fifty-six years. Thus, during one hundred and six years, the temples were shut and never opened." Moreover, Herodotus tells us that "the Egyptians so detested the memory of these kings that they do not much like even to mention their names. Hence they commonly call the pyramids after Philition, a shepherd, who at that time fed his flocks about the place." "After Chephren, Mycerinus, son of Cheops, ascended the throne. He reopened the temples, and allowed the people to resume the practice of sacrifice. He, too, left a pyramid, but much inferior in size to his father's. It is built, for half of its height, of the stone of Ethiopia," or, as Prof. Smyth (whose extracts from Rawlinson's translation I have here followed) adds, "expensive red granite." "After Mycerinus, Asychis ascended the throne. He built the eastern gateway of the temple of Vulcan (Phtha); and, being desirous of eclipsing all his predecessors on

the throne, left as a monument of his reign a pyramid of brick."

This account is so suggestive, as will presently be shown, that it may be well to inquire whether it can be relied on. Now, although there can be no doubt that Herodotus misunderstood the Egyptians in some matters, and in particular as to the chronological order of the dynasties, placing the Pyramid-kings far too late, yet in other respects he seems not only to have understood them correctly, but also to have received a correct account from them. The order of the kings above named corresponds with the sequence given by Manetho, and also found in monumental and hieroglyphic records. Manetho gives the names Suphis I., Suphis II., and Mencheres, instead of Cheops, Chephren, and Mycerinus; while, according to the modern Egyptologists, Herodotus's Cheops was Shofo, Shufu, or Koufou; Chephren was Shafre, while he was also called Nou-Shofo or Noum-Shufu as the brother of Shofo; and Mycerinus was Menhere or Menkerre. But the identity of these kings is not questioned. As to the true dates, there is much doubt, and it is probable that the question will long continue open; but the determination of the exact epochs when the several pyramids were built is not very important in connection with our present inquiry. We may, on the whole, fairly take the points quoted above from Herodotus, and proceed to consider the significance of the narrative, with sufficient confidence that in all essential respects it is trustworthy.

There are several very strange features in the account.

In the first place, it is manifest that Cheops (to call the first king by the name most familiar to the general reader) attached great importance to the building of his pyramid. It has been said, and perhaps justly, that it would be more interesting to know the plan of the architect who devised the pyramid than the purpose of the king who built it. But the two things are closely connected. The architect must have satisfied the king that some highly-important purpose, in which the king himself was interested, would be subserved by the structure. Whether the king was persuaded to undertake the work as a matter of duty, or only to advance his own interests, may not be so clear. But that the king was most thoroughly in earnest about the work is certain. A monarch in those times would assuredly not have devoted an enormous amount of labor and material to such a scheme unless he was thoroughly convinced of its great importance. That the welfare of his people was not considered by Cheops in building the Great Pyramid is almost equally certain. He might, indeed, have had a scheme for their good which either he did not care to explain to them or which they could not understand. But the most natural inference from the narrative is that his purpose had no reference whatever to their welfare. For though one could understand his own subjects hating him while he was all the time working for their good, it is obvious that his memory would not have been hated if some important good had eventually been gained from his scheme. Many a far-seeing ruler has been hated while living on account of the very work for which his memory hes been revered. But the memory of Cheops and his successors was held in detestation.

May we, however, suppose that, though Cheops had not the welfare of his own people in his thoughts, his purpose was nevertheless not selfish, but intended in some way to promote the welfare of the human race? I say his purpose, because, whoever originated the scheme, Cheops carried it out; it was by means of his wealth and through his power that the pyramid was built. This is the view adopted by Prof. Piazzi Smyth and others, in our own time, and first suggested by John Taylor. "Whereas other writers," says Smyth, "have generally esteemed that the mysterious persons who directed the building of the Great Pyramid (and to whom the Egyptians, in their traditions, and for ages afterward, gave an immoral and even abominable character) must therefore have been very bad indeed, so that the world at large has always been fond of standing on, kicking, and insulting that dead lion, whom they really knew not: he, Mr. John Taylor, seeing how religiously bad the Egyptians themselves were, was led to conclude, on the contrary, that those *they* hated (and could never sufficiently abuse) might, perhaps, have been preëminently good; or were, at all events, of *different religious faith* from themselves. . . . Combining this with certain unmistakable historical facts," Mr. Taylor deduced reasons for believing that the directors of the building designed to record in its proportions, and in its interior features, certain important religious and scientific truths, not for the people then living, but for men who were to come four thousand years or so after.

Although I do not propose to discuss here the evidence on which this strange theory rests, there are certain matters connecting it with the above narrative that must here be mentioned. The mention of the shepherd Philition, who fed

his flocks about the place where the Great Pyramid was built, is a singular feature of Herodotus's narrative. It reads like some strange misinterpretation of the story related to him by the Egyptian priests. It is obvious that if the word Philition did not represent a people, but a person, this person must have been very eminent and distinguished—a shepherd-king, not a mere shepherd. Rawlinson, in a note on this portion of the narrative of Herodotus, suggests that Philitis was probably a shepherd-prince from Palestine, perhaps of Philistine descent, "but so powerful and domineering that it may be traditions of his oppressions in that earlier age which, mixed up afterward in the minds of later Egyptians with the evils inflicted on their country by the subsequent shepherds of better-known dynasties, lent so much fear to their religious hate of Shepherd times and that name." Smyth, somewhat modifying this view, and considering certain remarks of Manetho respecting an alleged invasion of Egypt by shepherd-kings, "men of an ignoble race" (from the Egyptian point of view) "who had the confidence to invade our country, and easily subdued it to their power without a battle," comes to the conclusion that some Shemite prince, "a contemporary of, but rather older than, the patriarch Abraham," visited Egypt at this time, and obtained such influence over the mind of Cheops as to persuade him to erect the pyramid. According to Smyth, the prince was no other than Melchizedek, King of Salem, and the influence he exerted was supernatural. With such developments of the theory we need not trouble ourselves. It seems tolerably clear that certain shepherd-chiefs who came to Egypt during Cheops's reign were connected in some way with the designing of the Great Pyramid. It is clear also that they were men of a different religion from the Egyptians, and persuaded Cheops to abandon the religion of his people. Taylor, Smyth, and the Pyramidalists generally, consider this sufficient to prove that the pyramid was erected for some purpose connected with religion. "The pyramid, in fine," says Smyth, "was charged by God's inspired shepherd-prince, in the beginning of human time, to keep a certain message secret and inviolable for four thousand years, and it has done so; and in the next thousand years it was to enunciate that message to all men, with more than traditional force, more than all the authenticity of copied manuscripts or reputed history; and that part of the pyramid's usefulness is now beginning."

There are many very obvious difficulties surrounding this theory; as, for example—1. The absurd waste of power in setting supernatural machinery at work four thousand years ago, with cumbrous devices to record its object, when the same machinery, much more simply employed now, would effect the alleged purpose far more thoroughly; 2. The enormous amount of human misery and its attendant hatreds brought about by this alleged divine scheme; and, 3. The futility of an arrangement by which the pyramid was only to subserve its purpose when it had lost that perfection of shape on which its entire significance depended, according to the theory itself. But, apart from these, there is a difficulty, nowhere noticed by Smyth or his followers, which is fatal, I conceive, to this theory of the pyramid's purpose. The second pyramid, though slightly inferior to the first in size, and probably far inferior in quality of masonry, is still a structure of enormous dimensions, which must have required many years of labor from tens of thousands of workmen. Now, it seems impossible to explain why Chephren built this second pyramid, if we adopt Smyth's theory respecting the first pyramid. For either Chephren knew the purpose for which the Great Pyramid was built, or he did not know it. If he knew that purpose, and it was that indicated by Smyth, then he also knew that no second pyramid was wanted. On that hypothesis, all the labor bestowed on the second pyramid was wittingly and willfully wasted. This, of course, is incredible. But, on the other hand, if Chephren did not know what was the purpose for which the Great Pyramid was built, what reason could Chephren have had for building a pyramid at all? The only answer to this question seems to be that Chephren built the second pyramid in hopes of finding out why his brother had built the first, and this answer is simply absurd. It is clear enough that, whatever purpose Cheops had in building the first pyramid, Chephren must have had a similar purpose in building the second; and we require a theory which shall at least explain why the first pyramid did not subserve for Chephren the purpose which it subserved, or was meant to subserve, for Cheops. The same reasoning may be extended to the third pyramid, to the fourth, and, in fine, to all the pyramids, forty or so in number, included under the general designation of the Pyramids of Ghizeh or Jeezeh. The extension of the principle to pyramids later than the second is especially important, as showing that the difference of religion insisted on by Smyth has no direct bearing on the question of the purpose for which the Great

Pyramid itself was constructed. For Mycerinus either never left or else returned to the religion of the Egyptians. Yet he also built a pyramid, which, though far inferior in size to the pyramids built by his father and uncle, was still a massive structure, and relatively more costly even than theirs, because built of expensive granite. The pyramid built by Asychis, though smaller still, was remarkable as built of brick; in fact, we are expressly told that Asychis desired to eclipse all his predecessors in such labors, and accordingly left this brick pyramid as a monument of his reign.

We are forced, in fact, to believe that there was some special relation between the pyramid and its builder, seeing that each one of these kings wanted a pyramid of his own. This applies to the Great Pyramid quite as much as to the others, despite the superior excellence of that structure. Or rather, the argument derives its chief force from the superiority of the Great Pyramid. If Chephren, no longer perhaps having the assistance of the shepherd-architects in planning and superintending the work, was unable to construct a pyramid so perfect and so stately as his brother's, the very fact that he nevertheless built a pyramid shows that the Great Pyramid did not fulfill for Chephren the purpose which it fulfilled for Cheops. But, if Smyth's theory were true, the Great Pyramid would have fulfilled finally, and for all men, the purpose for which it was built. Since this was manifestly not the case, that theory is, I submit, demonstrably erroneous.

It was probably the consideration of this point, viz., that each king had a pyramid constructed for himself, which led to the theory that the pyramids were intended to serve as tombs. This theory was once very generally entertained. Thus we find Humboldt, in his remarks on American pyramids, referring to the tomb theory of the Egyptian pyramids as though it were open to no question. "When we consider," he says, "the pyramidical monuments of Egypt, of Asia, and of the New Continent, from the same point of view, we see that, though their form is alike, their destination was altogether different. The group of pyramids of Ghizeh and at Sakhara in Egypt; the triangular pyramid of the queen of the Scythians, Zarina, which was a stadium high and three in circumference, and which was decorated with a colossal figure; the fourteen Etruscan pyramids, which are said to have been inclosed in the labyrinth of the king Porsenna, at Clusium —were reared to serve as the sepulchres of the illustrious dead. Nothing is more natural to men than to commemorate the spot where rest the ashes of those whose memory they cherish, whether it be, as in the infancy of the race, by simple mounds of earth, or, in later periods, by the towering height of the tumulus. Those of the Chinese and of Thibet have only a few metres of elevation. Farther to the west the dimensions increase; the tumulus of the king Abyattes, father of Crœsus, in Lydia, was six stadia, and that of Ninus was more than ten stadia in diameter. In the north of Europe the sepulchre of the Scandinavian king Gormus and the queen Daneboda, covered with mounds of earth, are three hundred metres broad, and more than thirty high."

But while we have abundant reason for believing that in Egypt, even in the days of Cheops and Chephren, extreme importance was attached to the character of the place of burial for distinguished persons, there is nothing in what is known respecting earlier Egyptian ideas to suggest the probability that any monarch would have devoted many years of his subjects' labor, and vast stores of material, to erect a mass of masonry like the Great Pyramid, solely to receive his own body after death. Far less have we any reason for supposing that many monarchs in succession would do this, each having a separate tomb built for him. It might have been conceivable, had only the Great Pyramid been erected, that the structure had been raised as a mausoleum for all the kings and princes of the dynasty. But it seems utterly incredible that such a building as the Great Pyramid should have been erected for one king's body only—and that not in the way described by Humboldt, when he speaks of men commemorating the spot where rest the remains of those whose memory they cherish, but at the expense of the king himself whose body was to be there deposited. Besides, the first pyramid, the one whose history must be regarded as most significant of the true purpose of these buildings, was not built by an Egyptian holding in great favor the special religious ideas of his people, but by one who had adopted other views, and those not belonging, so far as can be seen, to a people holding sepulchral rites in exceptional regard.

A still stronger objection against the exclusively tombic theory resides in the fact that this theory gives no account whatever of the characteristic features of the pyramids themselves. These buildings are all, without exception, built on special astronomical principles. Their square bases are so placed as to have two sides lying east and west, and two lying north

and south, or, in other words, so that their four faces front the four cardinal points. One can imagine no reason why a tomb should have such a position. It is not, indeed, easy to understand why any building at all, except an astronomical observatory, should have such a position. A temple perhaps devoted to sun-worship, and generally to the worship of the heavenly bodies, might be built in that way. For it is to be noticed that the peculiar figure and position of the pyramids would bring about the following relations: When the sun rose and set south of the east and west points, or (speaking generally) between the autumn and the spring equinoxes, the rays of the rising and setting sun illuminated the southern face of the pyramid; whereas during the rest of the year, that is, during the six months between the spring and autumn equinoxes, the rays of the rising and setting sun illuminated the northern face. Again, all the year round the sun's rays passed from the eastern to the western face at solar noon. And, lastly, during seven months and a half of each year, namely, for three months and three-quarters before and after midsummer, the noon rays of the sun fell on all four faces of the pyramid, or, according to a Peruvian expression (so Smyth avers), the sun shone on the pyramid "with all his rays." Such conditions as these might have been regarded as very suitable for a temple devoted to sun-worship. Yet the temple theory is as untenable as the tomb theory. For, in the first place, the pyramid form —as the pyramids were originally built, with perfectly smooth slant-faces, not terraced into steps as now, through the loss of the casing-stones— was entirely unsuited for all the ordinary requirements of a temple of worship. And further, this theory gives no explanation of the fact that each king built a pyramid, and each king only one. Similar difficulties oppose the theory that the pyramids were intended to serve as astronomical observatories. For, while their original figure, however manifestly astronomical in its relations, was quite unsuited for observatory-work, it is manifest that if such had been the purpose of pyramid-building, so soon as the Great Pyramid had once been built, no other would be needed. Certainly none of the pyramids built afterward could have subserved any astronomical purpose which the first did not subserve, or have subserved nearly so well as the Great Pyramid those purposes (and they are but few) which that building may be supposed to have fulfilled as an astronomical observatory.

Of the other theories mentioned at the beginning of this paper none seem to merit special notice, except perhaps the theory that the pyramids were made to receive the royal treasures, and this theory rather because of the attention it received from Arabian *literati*, during the ninth and tenth centuries, than because of any strong reasons which can be suggested in its favor. "Emulating," says Prof. Smyth, "the enchanted tales of Bagdad," the court poets of Al-Mamoun (son of the far-famed Haroun-al-Raschid) "drew gorgeous pictures of the contents of the pyramid's interior. . . . All the treasures of Sheddad Ben Ad, the great antediluvian king of the earth, with all his medicines and all his sciences, they declared were there, told over and over again. Others, though, were positive that the founder-king was no other than Saurid Ibn Salhouk, a far greater one than the other; and these last gave many more minute particulars, some of which are at least interesting to us in the present day, as proving that, among the Egypto-Arabians of more than a thousand years ago, the Jeezeh pyramids, headed by the grand one, enjoyed a pre-eminence of fame vastly before all the other pyramids of Egypt put together; and that if any other is alluded to after the Great Pyramid (which has always been the notable and favorite one, and chiefly was known then as the East Pyramid), it is either the second one at Jeezeh, under the name of the West Pyramid; or the third one, distinguished as the Colored Pyramid, in allusion to its red granite, compared with the white limestone casings of the other two (which, moreover, from their more near, but by no means exact, equality of size, went frequently under the affectionate designation of 'the pair')."

The report of Ibn Abd Alkohm, as to what was to be found in each of these three pyramids, or rather of what, according to him, was put into them originally by King Saurid, runs as follows: "In the Western Pyramid, thirty treasuries filled with store of riches and utensils, and with signatures made of precious stones, and with instruments of iron and vessels of earth, and with arms which rust not, and with glass which might be bended and yet not broken, and with strange spells, and with several kinds of *alakakirs* (magical precious stones) single and double, and with deadly poisons, and with other things besides. He made also in the East" (the Great Pyramid) "divers celestial spheres and stars, and what they severally operate in their aspects, and the perfumes which are to be used to them, and the books which treat of these matters. He put also into the Colored Pyramid the commentaries of

the priests in chests of black marble, and with every priest a book, in which the wonders of his profession and of his actions and of his nature were written, and what was done in his time, and what is and what shall be from the beginning of time to the end of it." The rest of this worthy's report relates to certain treasurers placed within these three pyramids to guard their contents, and (like all or most of what I have already quoted) was a work of imagination. Ibn Abd Alkohm, in fact, was a romancist of the first water.

Perhaps the strongest argument against the theory that the pyramids were intended as strongholds for the concealment of treasure resides in the fact that, search being made, no treasure has been discovered. When the workmen employed by Caliph Al-Mamoun, after encountering manifold difficulties, at length broke their way into the great ascending passage leading to the so-called King's Chamber, they found "a right noble apartment, thirty-four feet long, seventeen broad, and nineteen high, of polished red granite throughout, walls, floor, and ceiling, in blocks squared and true, and put together with such exquisite skill that the joints are barely discernible to the closest inspection. But where is the treasure—the silver and the gold, the jewels, medicines, and arms? These fanatics look wildly around them, but can see nothing, not a single *dirhem* anywhere. They trim their torches, and carry them again and again to every part of that red-walled, flinty hall, but without any better success. Naught but pure polished red granite, in mighty slabs, looks upon them from every side. The room is clean, garnished too, as it were, and, according to the ideas of its founders, complete and perfectly ready for its visitors so long expected, so long delayed. But the gross minds who occupy it now, find it all barren, and declare that there is nothing whatever for them, in the whole extent of the apartment from one end to another; nothing except an empty stone chest without a lid."

It is, however, to be noted that we have no means of learning what had happened between the time when the pyramid was built and when Caliph Al-Mamoun's workmen broke their way into the King's Chamber. The place may, after all, have contained treasures of some kind; nor, indeed, is it incompatible with other theories of the pyramid to suppose that it was used as a safe receptacle for treasures. It is certain, however, that this cannot have been the special purpose for which the pyramids were designed. We should find in such a purpose no explanation whatever of any of the most stringent difficulties encountered in dealing with other theories. There could be no reason why strangers from the East should be at special pains to instruct an Egyptian monarch how to hide and guard his treasures. Nor, if the Great Pyramid had been intended to receive the treasures of Cheops, would Chephren have built another for his own treasures, which must have included those gathered by Cheops. But, apart from this, how inconceivably vast must a treasure-hoard be supposed to be, the safe guarding of which would have repaid the enormous cost of the Great Pyramid in labor and material! And then, why should a mere treasure-house have the characteristics of an astronomical observatory? Manifestly, if the pyramids were used at all to receive treasures, it can only have been as an entirely subordinate though perhaps convenient means of utilizing these gigantic structures.

Having thus gone through all the suggested purposes of the pyramids save two or three which clearly do not possess any claim to serious consideration, and having found none which appear to give any sufficient account of the history and principal features of these buildings, we must either abandon the inquiry or seek for some explanation quite different from any yet suggested. Let us consider what are the principal points of which the true theory of the pyramids should give an account.

In the first place, the history of the pyramids shows that the erection of the first great pyramid was in all probability either suggested to Cheops by wise men who visited Egypt from the East, or else some important information conveyed to him by such visitors caused him to conceive the idea of building the pyramid. In either case we may suppose, as the history indeed suggests, that these learned men, whoever they may have been, remained in Egypt to superintend the erection of the structure. It may be that the architectural work was not under their supervision; in fact, it seems altogether unlikely that shepherd-rulers would have much to teach the Egyptians in the matter of architecture. But the astronomical peculiarities which form so significant a feature of the Great Pyramid were probably provided for entirely under the instructions of the shepherd-chiefs who had exerted so strange an influence upon the mind of King Cheops.

Next, it seems clear that self-interest must have been the predominant reason in the mind of the Egyptian king for undertaking this stupendous work. It is true that his change of re-

ligion implies that some higher cause influenced him. But a ruler who could inflict such grievous burdens on his people in carrying out his purpose, that for ages afterward his name was held in utter detestation, cannot have been solely or even chiefly influenced by religious motives. It affords an ample explanation of the behavior of Cheops in closing the temples and forsaking the religion of his country, to suppose that the advantages which he hoped to secure by building the pyramid depended in some way on his adopting this course. The visitors from the East may have refused to give their assistance on any other terms, or may have assured him that the expected benefit could not be obtained if the pyramid were erected by idolaters. It is certain, in any case, that they were opposed to idolatry; and we have thus some means of inferring who they were and whence they came. We know that one particular branch of one particular race in the East was characterized by a most marked hatred of idolatry in all its forms. Terah and his family, or probably a sect or division of the Chaldean people, went forth from Ur of the Chaldees, to go into the land of Canaan—and the reason why they went forth we learn from a book of considerable historical interest (the book of Judith) to have been because "they would not worship the gods of their fathers who were in the land of the Chaldeans." And the Bible record shows that members of this branch of the Chaldean people visited Egypt from time to time. They were shepherds, too, which accords well with the account of Herodotus above quoted. We can well understand that persons of this family would have resisted all endeavors to secure their acquiescence in any scheme associated with idolatrous rites. Neither promises nor threats would have had much influence on them. It was a distinguished member of the family, the patriarch Abraham, who said, "I have lift up mine hand unto the Lord, the most high God, the possessor of heaven and earth, that I will not take from a thread even to a shoe-latchet, and that I will not take anything that is thine, lest thou shouldest say, I have made Abram rich." Vain would all the promises and all the threats of Cheops have been to men of this spirit. Such men might help him in his plans, suggested, as the history shows, by teachings of their own, but it must be on their own conditions, and those conditions would most certainly include the utter rejection of idolatrous worship by the king in whose behalf they worked, as well as by all who shared in their labors. It seems probable that they convinced both Cheops and Chephren that, unless these kings gave up idolatry, the purpose, whatever it was, which the pyramid was erected to promote, would not be fulfilled. The mere fact that the Great Pyramid was built either directly at the suggestion of these visitors, or because they had persuaded Cheops of the truth of some important doctrine, shows that they must have gained great influence over his mind. Rather, we may say, that he must have been so convinced of their knowledge and power as to have accepted with unquestioning confidence all that they told him respecting the particular subject over which they seemed to possess so perfect a mastery.

But having formed the opinion, on grounds sufficiently assured, that the strangers who visited Egypt and superintended the building of the Great Pyramid were kinsmen of the patriarch Abraham, it is not very difficult to decide what was the subject respecting which they had such exact information. They or their parents had come from the land of the Chaldeans, and they were doubtless learned in all the wisdom of their Chaldean kinsmen. They were masters, in fact, of the astronomy of their day, a science for which the Chaldeans had shown from the earliest ages the most remarkable aptitude. What the actual extent of their astronomical knowledge may have been it would be difficult to say. But it is certain, from the exact knowledge which later Chaldeans possessed respecting long astronomical cycles, that astronomical observations must have been carried on continuously by that people for many hundreds of years. It is highly probable that the astronomical knowledge of the Chaldeans in the days of Terah and Abraham was much more accurate than that possessed by the Greeks even after the time of Hipparchus.[1] We see, indeed, in the accurate astronomical adjustment of the Great Pyramid that the architects must have been skillful astronomers and mathematicians; and I may note here, in passing, how strongly this circumstance confirms the opinion that the visitors were kinsmen of Terah

[1] It has been remarked that, though Hipparchus had the enormous advantage of being able to compare his own observations with those recorded by the Chaldeans, he estimated the length of the year less correctly than the Chaldeans. It has been thought by some that the Chaldeans were acquainted with the true system of the universe, but I do not know that there are sufficient grounds for this supposition. Diodorus Siculus and Apollonius Mynidius mention, however, that they were able to predict the return of comets, and this implies that their observations had been continued for many centuries with great care and exactness.

and Abraham. All we know from Herodotus and Manetho, all the evidence from the circumstances connected with the religion of the pyramid-kings, and the astronomical evidence given by the pyramids themselves, tends to assure us that members of that particular branch of the Chaldean family which went out from Ur of the Chaldees because they would not worship the gods of the Chaldeans, extended their wanderings to Egypt, and eventually superintended the erection of the Great Pyramid so far as astronomical and mathematical relations were concerned.

But not only have we already decided that the pyramids were not intended solely or chiefly to subserve the purpose of astronomical observatories, but it is certain that Cheops would not have been personally much interested in any astronomical information which these visitors might be able to communicate. Unless he saw clearly that something was to be gained from the lore of his visitors, he would not have undertaken to erect any astronomical buildings at their suggestion, even if he had cared enough for their knowledge to pay any attention to them whatever. Most probably the reply Cheops would have made to any communications respecting mere astronomy would have run much in the style of the reply made by the Turkish cadi, Imaum Ali Zadè, to a friend of Layard's who had apparently bored him about double stars and comets: "O my soul! O my lamb!" said Ali Zadè, "seek not after the things which concern thee not. Thou camest unto us, and we welcomed thee: go in peace. Of a truth thou hast spoken many words; and there is no harm done, for the speaker is one and the listener is another. After the fashion of thy people, thou hast wandered from one place to another until thou art happy and content in none. Listen, O my son! There is no wisdom equal unto the belief in God! He created the world; and shall we liken ourselves unto him in seeking to penetrate into the mysteries of his creation? Shall we say, 'Behold this star spinneth round that star, and this other star with a tail goeth and cometh in so many years?' Let it go! He from whose hand it came will guide and direct it. But thou wilt say unto me, 'Stand aside, O man! for I am more learned than thou art, and have seen more things.' If thou thinkest that thou art in this respect better than I am, thou art welcome. I praise God that I seek not that which I require not. Thou art learned in the things I care not for; and, as for that which thou hast seen, I defile it. Will much knowledge create thee a double belly, or wilt thou seek paradise with thine eyes?" Such, omitting the references to the Creator, would probably have been the reply of Cheops to his visitors, had they only had astronomical facts to present him with. Or, in the plenitude of his kingly power, he might have more decisively rejected their teaching by removing their heads.

But the shepherd-astronomers had knowledge more attractive to offer than a mere series of astronomical discoveries. Their ancestors had—

> "Watched from the centres of their sleeping flocks
> Those radiant Mercuries, that seemed to move
> Carrying through ether in perpetual round
> Decrees and resolutions of the gods;"

and, though the visitors of King Cheops had themselves rejected the Sabaistic polytheism of their kinsmen, they had not rejected the doctrine that the stars in their courses affect the fortunes of men. We know that among the Jews, probably the direct descendants of the shepherd-chiefs who visited Cheops, and certainly close kinsmen of theirs, and akin to them also in their monotheism, the belief in astrology was never regarded as a superstition. In fact, we can trace very clearly in the books relating to this people that they believed confidently in the influences of the heavenly bodies. Doubtless the visitors of King Cheops shared the belief of their Chaldean kinsmen that astrology is a true science, "founded," indeed (as Bacon expresses their views), "not in reason and physical contemplations, but in the direct experience and observation of past ages." Josephus records the Jewish tradition (though not as a tradition, but as a fact) that "our first father, Adam, was instructed in astrology by divine inspiration," and that Seth so excelled in the science that, "foreseeing the Flood and the destruction of the world thereby, he engraved the fundamental principles of his art (astrology) in hieroglyphical emblems, for the benefit of after-ages, on two pillars of brick and stone." He says, farther on, that the patriarch Abraham, "having learned the art in Chaldea, when he journeyed into Egypt taught the Egyptians the sciences of arithmetic and astrology." Indeed, the stranger called Philitis by Herodotus may, for aught that appears, have been Abraham himself; for it is generally agreed that the word Philitis indicated the race and country of the visitors, regarded by the Egyptians as of Philistine descent and arriving from Palestine. However, I am in no way concerned to show that the shepherd-astronomers who induced Cheops to build the Great Pyramid were even contemporaries of Abraham and Melchizedek. What seems

sufficiently obvious is all that I care to maintain —namely, that these shepherd-astronomers were of Chaldean birth and training, and therefore astrologers, though, unlike their Chaldean kinsmen, they rejected Sabaism or star-worship, and taught the belief in one only Deity.

Now, if these visitors were astrologers, who persuaded Cheops, and were honestly convinced themselves, that they could predict the events of any man's life by the Chaldean method of casting nativities, we can readily understand many circumstances connected with the pyramids which have hitherto seemed inexplicable. The pyramid built by a king would no longer be regarded as having reference to his death and burial, but to his birth and life, though after his death it might receive his body. Each king would require to have his own nativity-pyramid, built with due symbolical reference to the special celestial influences affecting his fortunes. Every portion of the work would have to be carried out under special conditions, determined according to the mysterious influences ascribed to the different planets and their varying positions—

". . . . now high, now low, then hid,
Progressive, retrograde, or standing still."

If the work had been intended only to afford the means of predicting the king's future, the labor would have been regarded by the monarch as well bestowed. But astrology involved much more than the mere prediction of future events. Astrology claimed to possess the power of ruling the planets—that is, of course, not of ruling the motions of those bodies, but of providing against evil influences or strengthening good influences which they supposed the celestial orbs to exert in particular aspects. Thus we can understand that while the mere basement layers of the pyramid would have served for the process of casting the royal nativity, with due mystic observances, the further progress of building the pyramid would supply the necessary means and indications for ruling the planets most potent in their influence upon the royal career.

Remembering the mysterious influence which astrologers ascribed to special numbers, figures, positions, and so forth, the care with which the Great Pyramid was so proportioned as to indicate particular astronomical and mathematical relations is at once explained. The four sides of the square base were carefully placed with reference to the cardinal points precisely like the four sides of the ordinary square scheme of nativity.[1] The eastern side faced the Ascendant, the southern faced the Mid-heaven, the western faced the Descendant, and the northern faced the Imum Cœli. Again, we can understand that the architects would have made a circuit of the base correspond in length with the number of days in the year—a relation which, according to Prof. P. Smyth, is fulfilled in this manner, that the four sides contain one hundred times as many pyramid-inches as there are days in the year. The pyramid-inch, again, is itself mystically connected with astronomical relations, for its length is equal to the five hundred millionth part of the earth's diameter, to a degree of exactness corresponding well with what we might expect Chaldean astronomers to attain. Prof. Smyth, indeed, believes that it was exactly equal to that proportion of the earth's polar diameter—a view which would correspond with his theory that the architects of the Great Pyramid were assisted by divine inspiration; but what is certainly known about the sacred cubit, which contained twenty-five of these inches, corresponds better with the diameter which the Chaldean astronomers, if they worked very carefully, would have deduced from observations made in their own country, on the supposition which they would naturally have made that the earth is a perfect globe, not compressed at the poles. It is not indeed at all certain that the sacred cubit bore any reference to the earth's dimensions; but this seems tolerably well made out—that the sacred cubit was about twenty-five inches in length, and that the circuit of the pyramid's base contained a hundred inches for every day of the year. Relations such as these are pre-

[1] The language of the modern Zadkiels and Raphaels, though meaningless and absurd in itself, yet, as assuredly derived from the astrology of the oldest times, may here be quoted. (It certainly was not invented to give support to the theory I am at present advocating.) Thus runs the jargon of the tribe: "In order to illustrate plainly to the reader what astrologers mean by the 'houses of heaven,' it is proper for him to bear in mind the four cardinal points. The eastern, facing the rising sun, has at its centre the first grand angle or first house, termed the Horoscope or ascendant. The northern, opposite the region where the sun is at midnight, or the *cusp* of the lower heaven or nadir, is the Imum Cœli, and has at its centre the fourth house. The western, facing the setting sun, has at its centre the third grand angle or seventh house or descendant. And lastly, the southern, facing the noonday sun, has at its centre the astrologer's tenth house, or Mid-heaven, the most powerful angle or house of honor." "And although," proceeds the modern astrologer, "we cannot in the ethereal blue discern these lines or terminating divisions, both reason and experience assure us that they certainly exist; therefore the astrologer has certain grounds for the choice of his four angular houses" (out of twelve in all), "which, resembling the palpable demonstration they afford, are in the astral science esteemed the most powerful of the whole."—(RAPHAEL'S "Manual of Astrology.")

cisely what we might expect to find in buildings having an astrological significance. Similarly, it would correspond well with the mysticism of astrology that the pyramid should be so proportioned as to make the height be the radius of a circle whose circumference would equal the circuit of the pyramid's base. Again, that long slant tunnel, leading downward from the pyramid's northern face, would at once find a meaning in this astrological theory. The slant tunnel pointed to the pole-star of Cheops's time, when due north below the true pole of the heavens. This circumstance had no observational utility. It could afford no indication of time, because a pole-star moves very slowly, and the pole-star of Cheops's day must have been in view through that tunnel for more than an hour at a time. But, apart from the mystical significance which an astrologer would attribute to such a relation, it may be shown that this slant tunnel is precisely what the astrologer would require in order to get the horoscope correctly.

Another consideration remains to be mentioned, which, while strengthening the astrological theory of the pyramids, may bring us even nearer to the true aim of those who planned and built these structures.

It is known also that the Chaldeans from the earliest times pursued the study of alchemy in connection with astrology, not hoping to discover the philosopher's stone by chemical investigations alone, but by carrying out such investigations under special celestial influence. The hope of achieving this discovery, by which he would at once have had the means of acquiring illimitable wealth, would of itself account for the fact that Cheops expended so much labor and material in the erection of the Great Pyramid, seeing that, of necessity, success in the search for the philosopher's stone would be a main feature of his fortunes, and would therefore be astrologically indicated in his nativity-pyramid, or perhaps even be secured by following mystical observances proper for ruling his planets.

The elixir of life may also have been among the objects which the builders of the pyramids hoped to discover.

It may be noticed, as a somewhat significant circumstance, that, in the account given by Ibn Abd Alkohm of the contents of the various pyramids, those assigned to the Great Pyramid relate entirely to astrology and associated mysteries. It is, of course, clear that Abd Alkohm drew largely on his imagination. Yet it seems probable that there was also some basis of tradition for his ideas. And certainly one would suppose that, as he assigned a treasurer to the East Pyramid ("a statue of black agate, his eyes open and shining, sitting on a throne with a lance"), he would have credited the building with treasure also, had not some tradition taught otherwise. But he says that King Saurid placed in the East Pyramid, not treasures, but "divers celestial spheres and stars, and what they severally operate in their aspects, and the perfumes which are to be used to them, and the books which treat of these matters." [1]

But, after all, it must be admitted that the strongest evidence in favor of the astrological (and alchemical) theory of the pyramids is to be found in the circumstance that all other theories seem untenable. The pyramids were undoubtedly erected for some purpose which was regarded by their builders as most important. This purpose certainly related to the personal fortunes of the kingly builders. It was worth an enormous outlay of money, labor, and material. This purpose was such, furthermore, that each king required to have his own pyramid. It was in some way associated with astronomy, for the pyramids are built with most accurate reference to celestial aspects. It also had its mathematical and mystical bearings, seeing that the pyramids exhibit mathematical and symbolical peculiarities not belonging to their essentially structural requirements. And, lastly, the erection of the pyramids was in some way connected with the arrival of certain learned persons from Palestine, and presumably of Chaldean origin. All these circumstances accord well with the theory I have advanced; while only some of them, and these not the most characteristic, accord with any of the other theories. Moreover, no fact known respecting the pyramids or their builders is inconsistent with the astrological (and alchemical) theory.

[1] Arabian writers give the following account of Egyptian progress in astrology and the mystical arts: Nacrawasch, the progenitor of Misraim, was the first Egyptian prince, and the first of the magicians who excelled in astrology and enchantment. Retiring into Egypt with his family of eighty persons, he built Essous, the most ancient city of Egypt, and commenced the first dynasty of Misraimitish princes, who excelled as cabalists, diviners, and in the mystic arts generally. The most celebrated of the race were Naerasch, who first represented by images the twelve signs of the zodiac; Gharnak, who openly described the arts before kept secret; Hersall, who first worshiped idols; Sehlouk, who worshiped the sun; Saurid (King Saurid of Ibn Abd Alkohm's account), who erected the first pyramids and invented the magic mirror; and Pharaoh, the last king of the dynasty, whose name was afterward taken as a kingly title, as Cæsar later became a general imperial title.

On the whole, then, if it cannot be regarded as demonstrated (in its general bearing, of course, for we cannot expect any theory about the pyramids to be established in minute details), the astrological theory may fairly be described as having a greater degree of probability in its favor than any hitherto advanced.

—*Belgravia.*

IS THE MOON DEAD?

THE idea generally prevailing among astronomers respecting the moon's condition is that she is a dead planet, an orb which circles around the sun like her companion planet the earth; but is not, like the earth, the abode of living creatures of any sort. Formerly, indeed, other views were entertained. It was thought that the dark regions were seas, the bright regions continents—a view embodied by Kepler in the saying, "*Do maculas esse maria, do lucidas esse terras.*" But the telescope soon satisfied astronomers that there are no seas upon the moon. It has been noted that in two well-known passages of the "Paradise Lost," in which Milton touches on the work of Galileo with the telescope, he speaks of lands, mountains, rivers, and regions, but not of oceans or seas, upon the moon. Thus, in describing the shield of Satan, he compares it to

> ". . . . the moon, whose orb
> Through optic glass the Tuscan artist views
> At evening from the top of Fesole,
> Or in Val d'Arno, to descry new lands,
> Rivers, or mountains, on her spotty globe."

While again, in the fifth book, Raphael views the earth—

> ". . . . as when by night the glass
> Of Galileo, less assured, observes
> Imagined lands and regions in the moon."

We may well believe that had Galileo, in his interviews[1] with Milton, described appearances which (with his telescopic power) resembled seas or oceans, the poet would not have used so vague a word as "regions" in the third line of the last quoted passage, where the word "oceans" would so obviously have suggested itself. From the very beginning of the telescopic observation of our satellite, it became clear that no seas or oceans exist upon her surface. And as telescopic power has increased, and the minute details of the moon's surface have been more searchingly scrutinized, it has been seen that there are no smaller water-regions, no lakes, or rivers, not even any ponds, or rivulets, or brooks.

[1] *See* Milton's "Areopagitica."

But, indeed, while the close telescopic scrutiny of the moon was thus showing that there are no water-surfaces there, it was becoming also clear that no water could remain there under the sun's rays—that is, on the parts of the moon which are illuminated. For it was found that the moon has an atmosphere so rare that water would boil away at a very low temperature indeed. How rare the lunar atmosphere is we do not certainly know; but a number of phenomena show that it must be very rare indeed. Some of these have been already considered, along with other lunar phenomena, in an article which appeared in the *Cornhill Magazine* for August, 1873; and for this reason (especially as that article has since been republished) we do not here enter into this portion of the evidence, our object being to discuss here certain relations which were not dealt with in that earlier paper.

But now that astronomers have almost by unanimous consent accepted the doctrine of the development of our system, which involves the belief that the whole mass of each member of the system was formerly gaseous with intensity of heat, they can no longer doubt that the moon once had seas and an atmosphere of considerable density. The moon has, in fact, passed through the same changes as our own earth, though not necessarily in the same exact way. She was once vaporous, as was our earth, though not at the same time nor for so long a time. She was once glowing with intensity of heat, though this stage also must have continued for a much shorter time than the corresponding stage of our earth's history. Must we not conclude that after passing through that stage the moon was for a time a habitable world as our earth is now? The great masses of vapor and of cloud which had girt our moon's whole globe, even as in the youth of our earth her seas enwrapped her in cloud-form, must at length have taken their place as seas upon her surface. The atmosphere which had supported those waters must at first have been dense by comparison with the present lunar atmosphere, perhaps even by comparison with the present at-

mosphere of our earth. Then the glowing surface of the moon gradually cooled, until at length the moon must have been a fit abode for life. But whether, when thus swept and garnished into fitness for habitation, the moon actually became an inhabited world, is a question which will be variously answered according to our views respecting the economy of Nature in this respect. Those who hold that Nature makes nothing in vain will need only to ask whether the support of life is the one sole purpose which a planet can subserve; if that should appear probable, they would at once decide that the moon must during its habitable stage have been inhabited. Others who, looking around at the workings of Nature as known to us, perceive, or think they percive, that there is much which resembles waste in Nature, will be less confident on this point. They may reason that, as, of many seeds which fall upon the ground, scarce one subserves the one purpose for which seeds can be supposed to have been primarily intended, as many younglings among animals perish untimely, as even many races and types fail of their apparent primary purpose, so our moon, and possibly many such worlds, may never have subserved and never come to subserve that one chief purpose for which the orbs peopling space can be supposed to have been formed, if purpose indeed reigns throughout the universe.

But we are not here concerned to inquire carefully whether the moon ever was inhabited; we care only to show the probability, the all but certainty, that the moon during one stage of her existence was a habitable body, leaving the questions whether she ever actually had inhabitants, and what (if she had) their nature may have been, to the imagination of the reader. Most certainly there is little reason for believing that on *this* point men will ever have any real information for their guidance.

Combining together several considerations—viz., first that the moon must have been fashioned as a planet many millions of years before the earth, that her original heat must have been greatly less than that of the earth (corresponding to a reduction of many millions of years in the time required for cooling down to the habitable condition), that each stage of the moon's cooling must have lasted less by many millions of years than the corresponding stage for the earth's cooling, and that, lunar gravity being so much less than terrestrial gravity, the moon's vulcanian vitality must have lasted for a much shorter time than the earth's—we perceive that the moon must have passed that stage of her history which corresponded to that through which our earth is now passing, many, many millions of years ago. It would probably be no exaggeration whatever of the truth to say that more than a thousand millions of years have passed since the moon was a habitable world. But we may quite confidently assert that fully a hundred millions of years have passed since that era of her history. And as the changes which she has undergone since then have occurred at a much more rapid rate than those by which the earth is now passing on, and will continue to pass on for ages yet to come, toward planetary decrepitude, we may assert with equal confidence that the moon is passing through a stage of planetary existence which the earth will not reach for many hundreds of millions of years yet to come. The moon, thus regarded, presents to us a most interesting subject of study, because she illustrates, in general respects if not perhaps in details, the condition which our earth will attain in the remote future.

Let us, then, examine the principal features of the moon—those which may be regarded as characteristic, which, at any rate, distinguish her from the earth—and consider how far it is probable that our earth will one day present similar features. We can also inquire how far the moon's present condition may be regarded as that of a dead world, in this sense that she can neither now be, nor (under any conceivable circumstances) hereafter become, once again a habitable world as formerly she presumably was.

There is one very remarkable feature of the moon's motions which is commonly not explained as we are about to explain it, but in a way which would correspond better with the general views indicated in this article than the interpretation which seems to us preferable. We refer to the circumstance that the moon's rotation on her axis takes place in precisely the same time as her revolution around the earth. This is, in reality, a very strange feature, though it is often dismissed as if there were nothing very remarkable about it. In whatever way the arrangement was brought about, it is absolutely certain that the earth had her share in the work; and, again, no matter what explanation or set of explanations we accept, we find most interesting evidence suggested as to the moon's past condition.

According to one account, the moon was originally set spinning at a rate closely corresponding to her present rotation rate, and the earth, having by her attractive power somewhat elongated the moon toward herself, acted on this not-perfectly round body in such sort as gradual-

ly to coerce its motion of rotation into exact agreement with its motion of revolution. It is known that this would necessarily happen if the original approach to agreement between these motions had been sufficiently close. If we adopted this view, we should find ourselves in presence of the somewhat remarkable fact that the small moon was in the beginning set rotating so slowly that its day lasted as long as a lunar month. Such a rotation, as the result of some process of systematic evolution, could be readily accepted; but that this motion, which presents no recognizable advantages, and many most manifest inconveniences (for creatures living in the moon), should have been specially communicated to the moon by the creative hand, would not be an acceptable theory, even if we were not forced by overwhelming evidence to throw special creative acts very much farther back (to say the least) than the formation of our moon, or of any part of the solar system.

Another explanation which has been offered runs as follows: When the moon had oceans, the earth must have acted on those oceans in the same way as the moon now acts on the oceans of our earth. In one respect the earth must have acted more energetically, in another less. Being very much (eighty-one times) more massive than the moon, the earth necessarily exerts much more force on the moon's substance than the moon exerts on hers.[1] On the other hand, the relative *difference* between the pull on the nearest and remotest parts of the globe is less in the case of the earth drawing the waters of the moon (in old times) than in the case of the moon drawing the waters of the earth; for the moon is a much smaller globe than the earth; and this difference is the really effective force in the production of tides. Also it is probable that the moon never had a relatively large ocean-surface, as will presently be shown, and small seas (probably disconnected) could not be swept by a great tide-wave. Still we may suppose that there was once a tidal-wave, greater or less, sweeping athwart the lunar seas much in the manner of our own tidal-wave. Now, our tidal-wave is beyond doubt slowly checking the earth's motion of rotation, for the wave travels so as to meet the motion of rotation, which therefore to some slight degree it opposes. This will go on, until at length the rotation has been so reduced that the tidal-wave no longer affects it; or, in other words, until the earth's period of rotation corresponds with the period of the tidal-wave, viz., with the lunar month. Hundreds of millions of years will pass before that happens; but then we have seen that the moon *may* fairly be regarded as illustrating the earth's condition hundreds of millions of years hence. Accordingly, there is nothing absolutely incredible in the theory that during the remote ages when the moon had seas the tidal-wave which traversed them, continually retarding the moon's motion of rotation, gradually coerced it into absolute agreement with her motion of revolution around the earth. Still it must be admitted that the theory is not very easily to be accepted as it stands. The seas of the moon were probably less in relative extent, even when at their largest, than those of Mars now are, and such seas could have no tidal-waves which even in thousands of millions of years could reduce the moon's rate of rotation in any considerable degree; and, as we shall presently see, the duration of the era when the moon had seas can hardly have been measured by periods so vast. On the whole, while we may admit the probability that at some very distant time in the past the earth may have exerted influences on lunar seas resembling those which the moon now exerts on our seas, it does not appear to us probable that the peculiar feature we are now considering can be attributed either wholly or in very large degree to the retarding influence of tidal-waves upon the moon.

One other theory remains which seems to have more in its favor than either of those hitherto considered. Before the moon became a separate planet her frame, then vaporous, must have been enwrapped in the vaporous frame of the earth. While this continued the moon was necessarily compelled to move as a portion of the earth's outer envelope, and therefore, of course, turned upon her axis in the same time that that exterior portion of the earth revolved. So soon as the contraction of the earth's vaporous frame left the moon outside, she was free, *if she could*, to change her rate of rotation; that is to say, the earth's enwrapping vapor-masses no longer prevented the moon from changing her rotation rate. And there were two causes at work, either of which, if in action alone, would have markedly

[1] In one sense the moon pulls the earth just as strongly as the earth pulls the moon, for gravity is not a force which one body exerts on another solely, but a mutual force. But what mathematicians call the moving force exerted by the earth on the moon is eighty-one times greater than the corresponding force exerted by the moon on the earth; for the mutual attraction between these bodies has in the former case to move the moon, whereas in the latter it has to move the much larger mass of the earth.

changed the moon's rate of turning on her axis. *One* was the gradual contraction of the moon's frame in cooling. This would have made her turn more quickly on her axis. *The other* was the continually gathering-in of meteoric matter from without, which was a process taking place probably far more rapidly then than now, seeing that the meteoric systems now remaining are the merest residue of a residue compared with those existing hundreds of millions of years ago. This process would tend to make the moon turn more slowly upon her axis. However, the former process would probably operate far more effectively, and thus the moon would on the whole have acquired a more rapid rate of rotation, and the coincidence between rotation and revolution existing when she first had separate existence would have disappeared. But there was all the time a force at work to check the tendency to change in this respect. The earth was there, exerting that very force which we have already described in considering another theory—a force competent, we may infer, to check the tendency to a slow increase in the moon's rate of rotation, and to preserve that relation which existed when the moon was first formed. We say that the competence of this force may be inferred—meaning that the observed coincidence between the moon's rate of turning round upon her axis and her rate of revolution around the earth shows that the force was sufficient for that purpose. A similar force exerted by the sun upon the earth since she was first separately formed has not proved competent, as we know, to make the earth turn on her axis in the same time exactly that she travels round the sun; that is, in a year. Nor have any of the planets been forced to behave in this way. But we can readily understand that a great difference should exist between the formation of a planet which, having an enormously high temperature when first formed, would have an enormous amount of contraction to undergo; and the formation of a subordinate orb like the moon, which, though no doubt intensely hot when first thrown off[1] by the contracting earth, cannot have been nearly so hot as a planet at the corresponding stage of its existence. On the whole, there are (so it seems to us) good reasons for believing that that peculiar law of the moon's motion which causes the same lunar hemisphere to be constantly turned earthward had its origin during the birth itself of our satellite. We may, indeed, find in that peculiarity one of the strongest arguments in favor of the theory that our solar system reached its present condition by a process of development, since on no other theory can a satisfactory solution be obtained of the most striking peculiarity of the moon's motions.

But the inhabitants of earth are more directly interested—not for their own sake, but for the sake of their remote descendants—in the subject of the moon's present airless and waterless condition, regarded as the result of systematic processes of change. If we can ascertain what those processes may have been, and if we should find that similar processes are taking place, however slowly, on the earth, then the moon's present condition has in a sense the same sort of interest for us that a man in the full vigor of life might be supposed to find in the study of the condition of aged persons, if through some strange chance he had never had an opportunity of observing earlier the effects of old age upon the human frame. The inhabitant of earth who contemplates the moon's present wretched condition may be disposed—like Lydia van den Bosch when she saw Madame Bernstein's shaky hands and hobbling gait—to hope we "sha'n't be like her when we're old, anyhow;" but the probabilities are in favor of a young world following in the same path which those now old have followed, and so reaching the same condition. If the moon is really a much older world than the earth—and we have seen that in all probability she is—then she presents to us a picture of the condition which our earth will hereafter attain.

We had occasion in the article on the Moon, referred to above, to notice the theory advanced by Frankland in this country respecting the way in which the lunar air and seas have been caused to disappear; but we did not then enter into any very careful discussion of that theory, our purpose leading us to consider other matters. But in this place the theory must occupy a larger share of our attention. In passing, we may remark that the originator of the theory was Seeman, the German geologist; but it was independently advanced by Frankland in England, Stanislas Meunier in France, and Sterry Hunt in America.

In the first place, it is to be noted that no other theory seems available. Of three others which have been advanced, only one, Hansen's, according to which the seas and atmosphere of the moon have been drawn by lunar gravity to

[1] We here use the words "thrown off" as equivalent to "left behind." The theory that the moon was thrown off by the earth, or the earth by the sun, is altogether inconsistent with mechanical possibilities.

the farther or unseen hemisphere of the moon, needs serious refutation. (The other two are Whiston's theory, that a comet carried off the lunar seas and air; and the theory—whose author is unknown to us—that the lunar seas, and later the lunar atmosphere, have been frozen through the intensity of cold to which, in the long lunar nights, the moon is exposed.) But this theory is no longer entertained by astronomers, simply because it has been shown that the peculiarity of the moon's shape which had suggested the theory has been found, first, to have no real existence; and, secondly, to be incapable, if it existed, of exercising the supposed effect." [1]

The theory independently advanced by the four students of science named above is simply this, that seas formerly existing on the surface of the moon have been gradually withdrawn into the moon's interior, and that a similar process, but chemical rather than mechanical, has led to the withdrawal of the greater portion of the air which formerly enveloped the moon's frame.

It may be well, first, to inquire whether the moon is likely to have had originally an atmosphere of considerable density and oceans of considerable extent. Supposing, for the sake of argument, that the materials of the moon's mass (including air and water) were originally proportioned as to quantity very much like those of our earth's mass, it is easily seen that the quantity of air above each square mile, of the moon's surface, at the time when the moon had reached the stage of planetary development through which our earth is now passing, must have been very much less than the quantity of air now existing above each square mile of the earth's surface. For, the moon's mass being about an eighty-first part of the earth's, the mass of the lunar air must have been about an eighty-first part of the mass of our present atmosphere. But the moon's surface bears a much greater proportion to the earth's, being about a thirteenth. Whence it follows that, on the assumptions we have made, the quantity of air above each square mile of the moon's surface would be only about one-sixth part of the quantity above each square mile of the earth's surface. And this air being drawn downward only by lunar gravity, which has but about a sixth part of the energy of our terrestrial gravity, would be less compressed in the same degree on this account. One-sixth of the quantity of air being thus compressed with one-sixth the amount of force, it is clear that the density of the lunar air in that stage of the moon's existence would only be about one thirty-sixth of the density of our air. Similar reasoning applies to the water, except as to the compression under lunar gravity. The average quantity of water to each square mile of the moon's surface would be but about one-sixth part of the quantity there is for each square mile of the earth's surface. The relative extent of the lunar oceans would not be less in precisely the same degree, however. For, speaking generally, the bed of the ocean slopes downward from the shore-line in such a way that more than half, or a third, or a fourth, or so on, would have to be removed to diminish the surface by a half, a third, or a fourth, or so on, respectively. We may illustrate our meaning here by considering the relation between the quantity of water in a wineglass (supposed to be cone-shaped) and the surface of the water. Suppose the wineglass full at first, and the circular surface of the water to be three square inches, then if five-sixths of the water are thrown out, so that only one-sixth remains, the surface will not be reduced to one-sixth its former extent—that is, to one-half of a square inch, but will be about nine-tenths of a square inch. It is clear that in the case of an ocean having a bottom very steeply

[1] The idea was that the moon, though nearly spherical, is somewhat egg-shaped, the smaller end of the egg-shaped figure being directed toward our earth. Now, while it is perfectly clear that on this supposition the greater part of the moon's visible half would be of the nature of a gigantic elevation above the mean level, and would therefore be denuded (or might be denuded) of its seas and the denser parts of the air formerly covering it, yet it is equally clear that all round the base of this monstrous lunar elevation the seas would be gathered together, and the air would be at its densest. But it is precisely round the base of this part of the moon, or, in other words, round the border of the visible lunar hemisphere, that we should have the best chance of perceiving the effects of air and seas, if any really existed; and it is because of the absolute absence of all evidence of the kind that astronomers regard the moon as having no seas and very little air. It is worthy of notice that Hansen's theory was anticipated by the author of that clever little pamphlet called "The Lunar Hoax," who places the human inhabitants (the Bat-men) in the regions near the edge of the lunar disk, on the strength of some such views as Hansen advanced a quarter of a century later. Recently the *Chicago Times* published several columns of lunar-hoax matter, purporting to be an account of observations made in France with a new and exceedingly powerful reflecting telescope. The observations made with this instrument showed a number of lunar folks, whose movements rendered it manifest that they were prisoners undergoing some kind of penal servitude, the visible lunar hemisphere being a sort of Botany Bay or Cayenne for lunar offenders, while the other hemisphere is a comfortable place of abode for good moon people. But what an unhappy state of things is here suggested! Conceive a world, one half of whose surface is required as an abode for its malefactors!

sloping near the shore-line, and nearly level elsewhere, a large proportion of the water might be drawn off, and the ocean-surface still remain almost as great as before. We may assume as a mean and sufficiently probable hypothesis that the lunar oceans had a relative surface equal to between one-half and one-third of the present relative surface of the terrestrial oceans. That is to say, our oceans covering about 72 hundredths of the entire surface of the earth, we may assume that the lunar oceans covered between 36 and 24 hundredths of the entire surface of the moon. It will be seen presently that some importance attaches to this question of the probable surface of the seas on the moon, a portion of the evidence for the theory we are examining depending on this relation.

Let us next consider in what way the withdrawal of the lunar oceans into the moon's interior probably took place. On this point, Frankland's presentation of the theory is undoubtedly defective. In fact, it has been the weakness of the theory in this respect, as presented in England, which has in all probability prevented it from receiving the attention here which it fairly deserves. "The cooling of the moon's mass must," said Frankland, "in accordance with all analogy, have been attended with contraction, which can scarcely be conceived as occurring without the development of a cavernous structure in the interior. Much of the cavernous structure would doubtless communicate, by means of fissures, with the surface, and thus there would be provided an internal receptacle for the ocean, from the depths of which even the burning sun of the long lunar day would be totally unable to dislodge more than traces of its vapor." And he proceeds thus to analyze the amount of space which would be rendered available for the retreat of the lunar oceans: "Assuming the solid mass of the moon to contract on cooling at the same rate as granite, its refrigeration through only 180° of the Fahrenheit thermometer (the difference between the boiling and the freezing points) would create cellular space equal to nearly 14,500,000 cubic miles, which would be more than sufficient to ingulf the whole of the lunar oceans, supposing them to bear the same proportion to the mass of the moon as our own oceans bear to that of the earth."

But in reality no such cavernous structure could possibly be developed in the interior of a planet like the moon. Frankland's mistake, here, is similar to that made by Brewster and others, who have suggested that possibly the small mean density of the outer planets might be due to the existence of great void spaces in the interior of those bodies. So soon, however, as we make the roughest calculation of the pressures existing in the interior of even a small planet like the moon, we perceive that there could be no cavities. The most solid materials—steel, adamant, platinum—become plastic under pressures far less than those brought into action by the attractive energy of a planet's mass upon all parts of its interior, except those not far from the surface. Be it noticed that it is not, as some seem to suppose who have written on this subject, the force of gravity at different depths which has to be considered. *That* diminishes as the centre of the planet is approached. What we have really to consider is the pressure produced by the weight of the superincumbent mass above any given level, and this of course becomes greater and greater as the depth below the surface increases. If the rigidity of the solid substances forming the solid crust of a planet were such that any amount of pressure could be borne without impairing it, then of course the various layers of the crust would form a series of arches, stronger and stronger with approach to the centre, because of the increased compression, and therefore the increased density of their substance. There is no *a priori* reason, perhaps, why this should not be so. Compression, for example, *might* increase the rigidity or force-resisting power of the materials of the earth's substance in such sort that mines might be dug to any depth, and horizontal tunneling carried out from the lowest parts of any mine. But experiment shows that the fact is otherwise. Under great pressures the most solid substances become plastic. Steel behaved like a liquid in Tresca's experiments, affording the most conclusive evidence that at a depth of ten or twelve miles no steel walls, however massive, could defend a cavernous space from the surrounding pressures, which would simply crush in the steel until it formed one solid mass without interstices—at least with no interstices which could be seen if the steel were afterward brought up from that depth to be cut open and examined. It will be readily understood that at the depth of ten or twelve miles there can be no caverns into which the water of the oceans could be bodily withdrawn. Extending similar considerations to the moon, we perceive that there can be no caverns in the moon's interior at a greater depth than 60 or 70, or at the utmost 100 miles. Now, 100 miles is less than the twentieth part of the moon's diam-

eter, and the entire mass of the moon exceeds the mass of the outermost layer (to a depth of 100 miles) in about the proportion of four to one. So that, even on the assumption that all the external parts of the moon, to the depth of 100 miles, contracted in such a way as to leave cavernous spaces in the manner conceived by Frankland, there would not be nearly enough space for the lunar oceans, supposing them to bear the same proportion to the moon's mass which our ocean bears to the mass of the earth.

But, though cavernous spaces would not form throughout the interior of a planet, room would yet be found, even to the degree conceived by Frankland, for the waters of the planet. The greatest possible pressure to which the most solid rock can be exposed would not fill the capillary spaces which exist throughout the material of the rock, while the pressure on the water at great depths would force it into even minuter than capillary spaces. This has been conclusively shown during experiments entered upon for another purpose—viz., to determine the compressibility of water. For when, in 1661, Florentine academicians tried to compress water which had been inclosed within a globular shell of gold, they found that the water under great pressure forced its way through the pores of the gold, and stood on the outside of the globe like dew; and since that time the experiment has been repeated with globes of other metals, a similar result being obtained.

It follows from these considerations that, as a planet cools, more and more space is formed for the retreat of the planet's seas; and that in all probability in the extreme old age of a planet, when its whole frame to the very centre has been sufficiently cooled, space enough is thus formed to hold all the water which had once adorned the planet's surface.

If we consider the whole history of the moon's cooling, partly as indicated by her actual aspect, partly by the evidence given by the aspect of other planets, and partly as justly inferable from the laws of physics, we shall find abundant reason for believing that *her* seas at any rate might thus have been withdrawn. During the earlier stages of a planet's history, considered in the essay entitled "When the Seas were young" (*Cornhill* for August and October last), the seas are floating in the form of cloud and vapor above the planet's surface. In the next stage, when the crust is still hot, but not too hot for the waters to rest upon it, the process of cooling must take place more rapidly in the crust of the planet than in the planet's interior. All this time, then, the crust would be contracting upon the nucleus—a process which would leave no cavernous spaces between the crust and the nucleus for the waters to retreat to. From time to time the contracting crust would give way, exactly as a non-contracting crust would give way under the pressure of an expanding nucleus. The scene of such a catastrophe would be marked thereafter by a great crater at the place where the crust first gave way, and a series of radiating streaks marking the places where the crust was split open all around that spot. The signs of events such as these in the moon's earlier history are very manifest. There is the great lunar crater Tycho, which is clearly visible to the naked eye, near the lower part of the disk of the moon; and from this as a centre radiations extend in all directions, some of which run right across the visible lunar hemisphere, and probably extend right round the moon. These also can be seen with the naked eye; and they are so well marked in photographs of the moon that some supposed the earlier photographs by Draper and Rutherfurd in America, and by De la Rue in this country, were in reality only photographs of a peeled orange, the crater Tycho representing one end of the core, and the radiations corresponding to divisions between the sections of the orange. Besides this most remarkable case, there are six others, centres of radiating streaks on the moon's visible hemisphere, and doubtless others upon the unseen hemisphere. We have here clear evidence of the tremendous nature of the forces which were at work throughout the moon's frame in the earlier stages of her history, the disturbance in particular by which the radiations from Tycho were made having apparently wracked the whole frame of the moon. Directly, indeed, these considerations do not affect the theory we are considering, because no large portion of the lunar seas can by any possibility have retreated beneath the surface during this stage of her existence. But as showing the enormous store of heat which existed at that time (by far the larger part of which must have remained unexhausted when the next stage began) the consideration of these amazing evidences of disturbance has an important though indirect bearing on our subject.

After the crust had parted with the greater portion of the heat which it had possessed when first formed, it would cool, and therefore would contract but slowly. The nucleus, on the other hand, which had before contracted more slowly than the crust, would now contract more rapidly, leaving spaces between itself and the crust. And

then two things would happen. One would be the manifestation of vulcanian energy in consequence of the heat generated by the crust as it crushed its way downward upon the retreating nucleus. The other would be the influx of water wherever it found access to the cavernous spaces between the crust and the nucleus. It is probable that before this vulcanian era of the moon's history was completed a considerable portion of the lunar waters had taken its place permanently beneath the crust. It should be noticed that this era corresponds with a part of the earth's existence which is as yet far from being completed, even if it can be regarded as much more than begun. It is far from unlikely that the era during which a planet's crust is thus kept in constant activity by the retreating motion of the nucleus synchronizes with the period during which life exists on the planet's surface. During all this period, which may have lasted tens of millions of years, not only were portions of the waters of the moon gradually taking up their place in cavernous spaces between the crust and the retreating nucleus, but another process must have been at work to exhaust the lunar seas. When water falls upon a large land-surface in the form of rain, so that the surface is thoroughly drenched, a portion probably disappears permanently from the water-circulation of the globe. Of course, the greater portion is conveyed into the sea in the form of running water. Then, again, the drying of the surface means that the water which had moistened it is taken into the air again in the form of aqueous vapor. And this eventually assumes the form of visible cloud, and after sundry changes (during which it may many times in turn appear as cloud or disappear as vapor) it falls again in rain, and *may* be either restored in this way directly to the sea from which it came, or so fall on land-surface as to run into some stream communicating by brook, rivulet, river, and estuary, with the ocean. And some portion of the water which falls on land-surfaces, passing below the surface, feeds internal streams, and eventually appears again in the form of spring-water. But it cannot be doubted that a portion of the water which falls on dry land soaks its way downward, very slowly, perhaps, but steadily and continuously, thus removing itself from sight, and *pro tanto* diminishing the planet's surface-waters.

How much of the water would be removed by these causes, before the last stage of all began (at least the last change of a planet's existence as a body undergoing change) is not easily determined. Probably a quarter or a third of the water forming the original oceans of a planet might be withdrawn in one or other of these ways, leaving the rest to be removed during the refrigeration of the nucleus itself—a process requiring many millions, possibly hundreds of millions, of years for its completion.

In whatever way the withdrawal of the lunar seas was accomplished, it is certain that every particle of water has disappeared from the surface of the moon; and as there are clear signs of the former existence of extensive lunar seas, apart from the strong *a priori* considerations showing that the moon must once have had water on her surface, we have little choice but to admit that the waters of the moon have been withdrawn by such gradual processes as have been described above, and consequently that the era of the moon's existence as a habitable world is really removed from the present epoch by the enormous time-intervals required for the completion of those processes. In fact, we can see clearly pictured on the moon's face the evidence which shows that she has passed through all the stages of planetary life, from the time when her whole frame was glowing with intensity of heat, down to the period when she had reached the condition which our earth in the remote future must attain —that of a cold, dead orb, neither living itself (regarding physical changes as corresponding with vitality) nor capable of being the abode of living creatures. Extending the range of our survey, we find in the giant planets, Jupiter and Saturn, the evidence of an earlier stage than any of which the moon's present aspect affords direct evidence. The sun presents a yet earlier stage, while the gaseous nebulæ or masses of luminous star-vapor scattered through the immensity of space illustrate the earliest of all stages of cosmical existence of which we have any direct evidence. On the other hand, we see in Mars, with his small ocean-surface and rare atmosphere, the picture of a stage intermediate between that through which the earth is now passing, and the decrepit or death-like condition of the moon. Mercury, if we could examine his condition more satisfactorily than is the case, would probably illustrate a stage somewhat nearer to the moon's present condition. Venus, on the other hand, so far as can be judged, though a somewhat smaller planet than the earth, is in a somewhat earlier stage of planetary existence.

Although the moon may be regarded as to all intents and purposes dead, it must not be supposed that no changes whatever take place upon her surface. On the contrary, some of the peculiarities of the moon's condition must tend to cause even more rapid changes of certain or-

ders than take place in the case of our own earth. Thus the great length of the lunar day, and the moon's waterless condition and rare atmosphere, must help to cause a comparatively rapid crumbling of the moon's surface. During the long and intensely hot lunar day the rock-substance of the moon's surface must expand considerably, for it is raised to a degree of heat exceeding that of boiling water. During the long lunar night the surface is exposed to a degree of refrigeration far exceeding that of the bitterest winter in the arctic regions, and must contract correspondingly. This alternate expansion and contraction must gradually crumble away all the loftiest and steepest portions of the moon's surface, and will doubtless, in the long-run—that is, some few hundreds of millions of years hence—destroy all the most marked irregularities of the moon's surface.

The cases of change which have been recognized by telescopists who have carefully studied the moon's surface may all, without exception, be referred to this process of gradual but steady disintegration. The most remarkable case hitherto known, for example, the disappearance of the lunar crater Linné, is far better explained in this way than as the result of volcanic outburst. This case has recently been described as follows, by the present writer: In the lunar Sea of Serenity there was once a deep crater, nearly seven miles across, a very distinct and obvious feature, even with the small telescope (less than four inches in aperture) used by Beer and Mädler in forming their celebrated chart. But, ten years ago, the astronomer Schmidt, a selenographer of selenographers (who has in fact given the best energies of his life to moon-gazing), found this crater missing. When he announced the fact to the scientific world, other astronomers, armed with very powerful instruments, looked for the crater which had been so clearly seen with Mädler's small telescope; but though they found a crater, it was nothing like the crater described by Mädler. The present crater is scarcely two miles in diameter, and only just visible with powerful telescopes; all around it there is a shallow depression, occupying a region about as large as the whole crater had been before. It seems impossible to doubt that a great change has taken place here, and the question arises whether the change has been produced by volcanic activity or otherwise. Sir John Herschel pronounced somewhat confidently in favor of the former hypothesis. "The most plausible conjecture," said he, "as to the cause of this disappearance, seems to be the filling up of the crater from beneath, by an effusion of viscous lava, which, overflowing the rim on all sides, may have so flowed down the outer slope as to efface its ruggedness, and convert it into a gradual declivity casting no stray shadows." "But how tremendous the volcanic energy," we note in the passage referred to, "required to fill with lava a crater nearly seven miles in diameter, and more than half a mile deep! The volcanic hypothesis seems on this account utterly incredible, for if such energy resided in the moon's interior we should find her whole surface continually changing. Far more probable seems the idea that the wall of this crater has simply fallen in, scattering its fragments over what had once been the floor of the crater. The forces at work on the moon are quite competent to throw down steep crater-walls like those which seem formerly to have girt about this deep cavity." [1]

That the kind of vitality evidenced by such changes as these still exists in the moon's frame, is not merely probable but certain. Other changes, however, which were once supposed to have been observed, must be dismissed as having had no real existence. The effects of various kinds of illusion have to be taken into account in considering such phenomena. Thus the theory that a process of monthly change, due perhaps to vegetation, affects the floor of the large lunar crater Plato (called by Hevelius the greater Black Lake), is now rejected, because the supposed change has been shown to be a mere effect of contrast. The apparent change is of this nature: As the sun first begins to rise above the floor of the crater—or, in other words, as the light of the filling moon gradually flows over the crater—the floor appears bright, getting brighter and brighter as the sun rises higher and higher, up to a certain point. But afterward the floor darkens, becoming darkest toward lunar mid-day. Lastly, as the lunar afternoon progresses, the floor of Plato gets gradually lighter again. The mid-day darkening was attributed to some process of vegetation or else to chemical changes. It has no real existence, however, but is due simply to the effect of contrast with the great brightness of the crater-wall all around, which is formed of some very white substance, and looks peculiarly bright and lustrous at the time of lunar mid-day, so that contrasted with it the floor looks peculiarly dark. On the other hand, during the morning and evening hours, the black shadow of the crater-wall is thrown across the floor, which by contrast looks brighter than it really is. This explanation has indeed been denied very con

[1] The present writer, in the *Spectator* for June 24, 1876.

fidently by some who formerly advocated the theory that lunar vegetation causes the darkening of the floor; but there can be no doubt of its justice, for no one (not prejudiced in favor of a theory) who has tested the matter experimentally, eliminating the effects of contrast, has failed to find that there is no real darkening of the floor of Plato.

It seems as certain as any matter not admitting of actual demonstration can be that the moon is, to all intents and purposes, dead. Her frame is, indeed, still undergoing processes of material change, but these afford no more evidence of real planetary life than the changes affecting a dead body are signs of still lingering vitality. Again, it seems certain that the processes through which the moon has passed in her progress toward planetary death must be passed through in turn by all the members of the solar system, and finally by the sun himself. Every one of these orbs is constantly radiating its heat into space, not indeed to be actually lost, but still in such sort as to reduce all to the same dead level of temperature, whereas vitality depends on differences of temperature. Every orb in space, then, is tending steadily onward toward cosmical death. And, so far as our power of understanding or even of conceiving the universe is concerned, it seems as though this tendency of every individual body in the universe toward death involved the tendency toward death of the universe itself. It may indeed be said that since the universe is of necessity infinite, whereas we are finite, we cannot reason in this way from what we can understand, or conceive, to conclusions respecting the universe, which we cannot even conceive, far less understand. Still it must be admitted that, so far as our reasoning powers can be relied upon at all, the inference, from what we know, appears a just one, that the life of the universe will have practically departed when the largest and therefore longest-lived of all the orbs peopling space has passed on to the stage of cosmical death. So far as we know, there is but one way of escape from this seemingly demonstrated, but in reality incredible, conclusion. May it not be that as men have erred in former times in regarding the earth as the centre of the universe, as they have erred in regarding this period of time through which the earth is now passing as though it were central in all time, so possibly they may have erred in regarding the universe we live in, and can alone comprehend, as though it were the only universe. May there not be a higher order of universe than ours, to which ours bears some such relation as the ether of space bears to the matter of our universe? and may there not, above that high order, be higher and higher orders of universe, absolutely without limit? And, in like manner, may not the ether of space, of which we know only indirectly though very certainly, be the material substance of a universe next below ours,[1] while below that are lower and lower orders of universe absolutely without limit? And, as the seemingly wasted energies of our universe are poured into the universe next below ours, may it not well be that our universe receives the supplies of energy wasted (in seeming) from the universe next in order above it? So that, instead of the absolute beginning and the absolute end which we had seemed to recognize, there may be in reality but a continual interchange between the various orders of universe constituting the true universe, these orders being infinite in number even as each one of them is infinite in extent. We find ourselves lost, no doubt, in the contemplation of these multiplied infinities; but we are equally lost in the contemplation of the unquestioned infinities of space and time amid which our little lives are cast, while the mystery of infinite waste, which seems so inscrutable when we consider the universe as we know it, finds a possible interpretation when we admit the existence of other orders of universe than the order to which our lives belong. Thus should we find a new argument for the teaching of the poet who has said:

> "Let knowledge grow from more to more,
> But more of reverence in us dwell,
> That, mind and soul according well,
> May make our music as before,
> But vaster;"

a new significance in the vision of him who said:

> "See all things with each other blending,
> Each to all its being lending,
> All on each in turn depending;
> Heavenly ministers descending,
> And again to heaven uptending,
> Floating, mingling, interweaving,
> Rising, sinking, and receiving—
> Each from each, while each is giving
> On to each, and each relieving
> Each—the pails of gold; the living
> Current through the air is heaving;
> Breathing blessings see them bending,
> Balanced worlds from change defending,
> While everywhere diffused is harmony unending."

—*Cornhill Magazine.*

[1] The work called "The Unseen Universe" presents a portion of the evidence to this effect, but unfortunately the style of that work is not sufficiently lucid to bring its reasoning within the range of the general non-scientific reader.

COOL ADVICE.

ONE of the oddest ideas of the confused British mind is that it is slightly feeble to mind great heat, at least if the heat be European, and slightly effeminate or over-luxurious to use elaborate means for its reduction. We are all devoted to comfort, or at least foreigners think so; but the very men who will spend money, and devote time, and use their whole intelligence, to raise a low thermometer, who put up elaborate and rather dangerous systems of hot-water pipes in their houses, and edge doors with gutta-percha, and regulate fires by thermometers and never-ending scoldings, think it slightly ridiculous to mind a degree of heat which inflicts as much discomfort as a frost, and would smile depreciatively if they heard that a neighbor slept with ice-blocks in his room. They will indeed provide for fresh air, because for ventilation they have the excuse of health; but heat they think it right to accept as an evil, only properly to be encountered by querulous endurance. We confess we do not see the sense of the distinction. It is true that in this country respectable people seldom drop down dead from heat and glare, though soldiers, reapers, and carters, frequently do, but neither do they drop down dead from cold; and if it is right to avoid the one sort of discomfort, so it is the other, and with the observatory at Greenwich recording a temperature of 92° in the shade—the highest, according to one newspaper, recorded since the observatory opened its register—and London as hot by night as by day, and the glare continuing unbroken for weeks on end, heat becomes to many constitutions a serious danger, and to all a disability quite as well worth preventing as the disability which arises from cold. It is pitiable to see the misery of people who are at once fat and xanthous, even though we may know that they in particular, being "ready sweaters," are almost exempt from the serious consequences of heat; and there are temperaments, more especially among children and sickly women, which are liable to serious injury. It is not sybaritic to avert sea-sickness; and with men and women of the constitution which resents heat—a peculiarity dependent partly on the state of the lungs and partly on that of the skin—no short fit of sea-sickness will inflict more positive suffering than two or three consecutive nights of sleeplessness from heat.

It is quite worth while, then, to mention the two or three preventives of great heat, especially at night, which in tropical climates Europeans have been taught by long and varied experience to adopt, and which only seem absurd to Englishmen at home from ignorance of the whole subject. The first and foremost of these is to keep quietly at home out of the sun and its temporarily injurious light. Englishmen in the West or East Indies, or in China, would be considered simply crazy if they walked about with the thermometer marking 100° in the sun, with their necks unprotected, as Londoners have been doing all this week. Experienced residents would tell them that no change of dress, no attention to diet, no carefulness about cleanliness, will give them half the serenity and comfort they will obtain from stopping at home; that when the thermometer ranges above 80° in the shade, the impact of the sun's rays is positively and directly injurious to the constitution, producing physical deteriorations which may affect them for life. Not only are the effects of a sunstroke permanent, and liable to reappear on hot days even in cold climates, but the effects of exposure to the sun, though not producing sunstroke, are often recognizable for years, producing, among other well-ascertained consequences, a distinctly separate liability to be affected by any form of alcohol—the key, we believe, to the extraordinary mischief drink works among the southern races, and the key also, most fortunately for them, of their instinctive aversion to liquor. It is not the heat, but the light of the sun, which produces these consequences, for a good umbrella prevents them; and the man who must be abroad in the light of days like last Tuesday should carry one as carefully as he does when he is only afraid of spoiling his hat. Two seconds will sometimes do the mischief, and he had much better bear being told that he is careful of a bad complexion than incur a permanent liability to suffer whenever he takes a glass with a friend. Next to keeping quiet, and as much out of the glare as possible, is the use of cool water in profusion, and that not only to drink, though water-drinking is probably beneficial. Nature makes very few blunders, and the dislike of repeated draughts of water, which is shared, we believe, even by some physicians, is as irrational as would be a dislike of stokers to put on fuel where fire is needed. All the tropical races in summer drink hard of water—even the Bengalese,

who, by pouring it straight into their throats, lose all its pleasant coolness in the mouth. The *New York Times*, we see, objects to iced-water, but the *New York Times* is only laughing at the teetotalers through a *bizarre* use of their alarmist phraseology. Water iced till it trembles on the verge of solidification, and taken after a full meal, may injure some weak stomachs; but water iced till it has the temperature of a cool spring will hurt nobody at any time or in any quantity whatever that an ordinary appetite is likely to crave. One would think, to hear some people talk, that thirst was in itself a good, instead of a symptom of exhaustion. But water has other qualities than the allaying of thirst. It has a permanent determination to evaporate, which Nature obeys, and, as it cannot evaporate without heat, it positively diminishes in the process the heat of our rooms. Pans of water, the cooler the better, stationed about a bedroom will positively reduce, not the sensation of heat, but the heat itself. Let anybody who doubts that have his tub, with its shallow depth and wide surface, filled with spring-water, or water with a good block of ice in it, and placed in his bedroom, and mark in half an hour how many degrees the thermometer has fallen. It ought to be 6° at least, and will be 8° if he is not stingy with his ice, and the improvement, equivalent in comfort to a fire on a winter's night, will last for hours. If that is still insufficient, let him throw up his bedroom windows, fasten an old blanket or traveling-rug across the space, and drench that well with water, and in five minutes the air in the room will be reduced to that water's temperature. Never mind about breeze. The air will seek the cooler place of itself, without being driven in from the outside, and the temperature will decline almost instantaneously to a reasonable point. Not one of those expedients necessitates any architectural improvements, or any change of habits, or any expense whatever, though of course a shilling or two laid out on ice will make the improvement more rapid, and in the case of a sick-room, or of any one who really suffers from heat—suffers as if in sickness, we mean—will be money well laid out. And so in the case of little children, especially, will a few shillings on the sheet of woven cane—we have unfortunately forgotten the trade-name—which is used in the hottest corners of the East Indies and China for pillow-cases and sofa-covers. The silica with which this material is coated will not get warm, and every other covering for beds or pillows with which we are acquainted will. It keeps perfectly dry, cannot get dirty, and can be procured as soft as any covering that ever was placed upon a mattress. There is hardly any luxury like it in intense and stifling heat, and we have known sick people, half maddened with heat acting on exhausted frames, sleep on it when sleep seemed otherwise unprocurable. With plenty of wholesome water, wetted blankets for window-curtains, and a sheet of cane, no one in London ought to be rendered sleepless by heat, or indeed, unless he persists in gorging himself with the food which he needs only in cold weather, to suffer any appreciable discomfort.

We may add one word about bathing. The tendency of human nature in hot weather is to bathe in cold water, and Nature, as we said before, seldom blunders; but Nature sometimes provides rather for health than comfort. A bathed man can work or walk in hot weather much better than an unbathed man, because he will perspire more freely, which Nature, not having considered the question of clothes fully, intended him to do. But it is extremely doubtful whether bathing at night tends to produce sleep so much as rheumatism from chilled perspiration. The head is the better for sponging, but the body, more especially in an artificially-cooled room, is the better for being dry, with the blood as far from the surface as possible, and the whole man as quiescent and torpid as the heat will allow him to be.—*Spectator.*

BRIEF NOTES.

Waste of Power at Niagara.—Dr. Siemens, in an address to the London Iron and Steel Institute, referred to several instances of available power being lost, owing to the inadequacy of our present means of utilizing it. The falls of Niagara are, he said, a familiar example of this. The amount of water passing over this fall has been estimated at 100,000,000 tons per hour, and its perpendicular descent may be taken at 150 feet, without counting the rapids, which represent a further fall of 150 feet. But the force represented by the principal fall alone amounts to 16,800,000 horse-power. In other words, all the coal raised throughout the world would barely suffice to produce the amount of power that continually runs to waste at this one fall. Much of this power might be turned to account on the spot by means of water-wheels, but the district around about is devoid of mineral wealth or other natural inducements for the establishment of factories. Dr. Siemens then mentions plans for carrying and utilizing water-power at a distance of one or two miles. But the problem still remains, How shall power be carried to great distances? Dr. Siemens suggests the electrical conductor. "Suppose," he says, "water-power to be employed to give motion to a dynamo-electrical machine, a very powerful electrical current is the result. This may be carried to a great distance, through a large metallic conductor, and there be made to impart motion to electro-magnetic engines to ignite the carbon-points of electric lamps, or to effect the separation of metals from their combinations. A copper rod of three inches in diameter would be capable of transmitting 1,000 horse-power a distance of say thirty miles, an amount sufficient to supply 225,000 candle-power, which would suffice to illuminate a moderately-sized town."

Do Birds hibernate?—In the course of a review of a work on "The Migration of Birds," a writer in *Nature* ridiculed the idea of birds "hibernating," and asserted that there is absolutely no valid evidence in favor of the supposition that birds ever lie dormant. But now comes a communication to the same journal from the Duke of Argyll, inclosing a letter from Sir John McNeill, who very distinctly upholds the contrary opinion, namely, that birds do hibernate. Having, in company with Sir Henry Rawlinson, during a very severe frost, visited a place called Kenaragird, near the Persian capital, for the purpose of duck-shooting, he came to a spot where, in the bank of a stream, there had been a small landslip. On the ground between the detached portion and the perpendicular face from which it had broken off, he saw twenty or thirty swallows, all alive, but dormant. On the perpendicular face of the bank was visible a vast number of holes about the size of rat-holes, and in them were swallows in the dormant state, many of which Sir John pulled out. Each hole contained several swallows, all lying with their heads inward, each head touching the tail of the bird before it. How far these holes penetrated into the bank, or what number of swallows each contained, he did not ascertain; but it is plain that the original entrance to these dormitories must have been in the external face of the portion that had slipped, which, in the middle, was from ten to twelve feet thick. The holes in the undisturbed portion may have been of equal or greater length; and if so the number of swallows hibernating here must have amounted to many hundreds.

Sir William Grove on the Radiometer.—Sir William Grove, in two communications to the Philosophical Club, abstracts of which have appeared in *Nature*, describes some experiments made by him with a modification of Mr. Crookes's radiometer, and the result of which appears to show that all the effects observed in this instrument are due to residual air. In the modified radiometer used in these experiments the four aluminium vanes, each blackened on one side, had metallic arms, and a metal point at their crossing that rested in a metal cup. The latter was united to a platinum wire passing through a glass tube and fused into it, the end of the wire protruding. Finally, the tube was fused inside the stem of the radiometer-bulb, the end of the platinum wire being exposed. Mr. Crookes pronounced the vacuum to be as perfect as in radiometers generally. With this instrument the following results were obtained: 1. With the light of a lucifer-match, or of one or two candles, the vanes invariably turned in the opposite way to the normal, the polished surface being repelled; with dark heat they turned in the normal way. 2. On electrizing the protruding platinum wire with a rubbed rod of glass or sealing-wax, the

vanes rotated sometimes one way, sometimes the other. 3. On connecting the negative pole of a Ruhmkorf coil the results were uncertain, but the positive pole caused the vanes to rotate steadily. In the dark the effect was very beautiful, as the dark vanes moved through a phosphorescent glow. As the apparatus seemed in the course of these experiments to have leaked, it was reëxhausted. It now acted normally, the black faces of the vanes being repelled by heat and light. On electrizing the wire by a Ruhmkorf coil there was now no luminosity, nor did the current pass. But, though the current was incapable of traversing the one-tenth of an inch of distance between the vanes and the glass, induction acted across it as before. From this it is apparent that the effects of attenuation of air upon discharge and upon induction are not the same. When attenuation has commenced and is increasing, the discharge passes more and more rapidly, until it becomes a glow; but a further attenuation stops the discharge entirely. On the other hand, induction continues, and appears to be in no way lessened byextreme attenuation.

Nickeliferous Iron-Ores.—An analysis of some native iron from Brazil, made by M. Damour, shows an extraordinarily high proportion of nickel, namely 38 per cent., or considerably above the ordinary proportion of nickel in meteoric iron. The metal, which has a very fine grain, and a lustre like that of steel, exhibits the so-called Widmanstättian figures when a polished surface of it is acted on by an acid. Strange to say, it resists for an indefinite length of time the combined action of air and water, without showing the least sign of oxidation. The results of Damour's experiments with this iron having been laid before the Paris Academy of Sciences, Boussingault remarked that, according to Berzelius, meteoric iron is not oxidizable by moist air. He also called attention to certain experiments he himself had formerly made with a view to rendering iron unoxidizable by incorporating with it nickel. Having added successively 5, 10, and 15 per cent. of nickel, he very unexpectedly found that the alloy was more oxidizable than pure iron. But if 38 per cent. of nickel—the proportion found in the iron from Brazil—be added, the alloy is absolutely unoxidizable. M. Stanislas Meunier, who reports the transactions of the Academy for *La Nature*, hereupon observes that, if Berzelius's proposition be true, then Boussingault's explanation is insufficient, for in meteoric irons the nickel is in the proportion of only 8 per cent., and of course they should be very oxidizable. Some specimens of the Brazil iron were presented to the Academy by M. Daubrée. They are of interest, owing to the intrusion of magnetic pyrites, or pyrrhotine, which they present. These specimens were broken off from great masses of the iron found in the province of Santa Catarina. The iron appears to be of terrestrial origin.

Injurious Effects of High-heeled Shoes.—The remarks of Dr. Onimus, of Paris, upon the injurious effects on women, of wearing shoes with high heels, are timely, and deserve to be seriously considered. As the fashion goes, the heel of the boots is not only high, but narrow and inclined forward, so that the distance between the heel and the point of the foot is lessened, and the foot appears to be smaller than it really is. The effect of this is to remove the weight of the body from its natural support, the prominence of the *os calcis*, and project it forward on the plantar arch. Hence often acute pain in the sole of the foot, and serious injuries to the anterior joints. The toes, instead of the heel, first touch the ground, becoming permanently flexed and pressed together; partly in consequence of the narrowness of the front part of the boot, partly in consequence of the over-action of the flexors of the toes. Other muscles are also involved; indeed, all those which are concerned in maintaining the erect attitude of the body. In nervous temperaments hysterical symptoms have been produced by the pain and irritation. Grave constitutional troubles are not infrequently the result of persistence in this ridiculous fashion.

THE BIBLE.[1]

By Professor W. ROBERTSON SMITH, of the University of Aberdeen.

I.—THE OLD TESTAMENT.

THE word *Bible*, which in English, as in mediæval Latin, is treated as a singular noun, is in its original Greek form a plural—*τὰ βιβλία*, *the (sacred) books*—correctly expressing the fact that the sacred writings of Christendom are made up of a number of independent records, which set before us the gradual development of the religion of revelation. The origin of each of these records forms a distinct critical problem; and for the discussion of these questions of detail the reader is referred to the articles on separate Biblical books. The present article seeks to give a general account of the historical and literary conditions under which the unique literature of the Old and New Testaments sprang up, and of the way in which the Biblical books were brought together in a canonical collection, and handed down from age to age. The Biblical development is divided into two great periods by the manifestation and historical work of Christ. In its pre-Christian stage the religion of revelation is represented as a *covenant* between the spiritual God and his chosen people the Hebrews. In accordance with this, and in allusion to Jeremiah xxxi. 31, Jesus speaks of the new dispensation founded in his death as a new *covenant* (2 Corinthians xi. 25). Hence, as early as the second century of our era the two great divisions of the Bible were known as the books of the Old and of the New Covenant respectively. Among Latin-speaking Christians the Greek word for covenant was often incorrectly rendered *testament*, and thus Western Christendom still uses the names of the Old and New Testaments.

Old Testament—Struggle and Progress of Spiritual Religion; Priests, Prophets, etc.—The pre-Christian age of the Biblical religion falls into a period of religious productivity and a subsequent period of stagnation and mainly conservative tradition. The period of productivity is also a period of contest, during which the spiritual principles of the religion of revelation were involved in continual struggle with polytheistic Nature-worship on the one hand, and, on the other hand, with an unspiritual conception of Jehovah as a God whose interest in Israel and care for his sanctuary were independent of moral conditions. In this long struggle, which began with the foundation of the theocracy in the work of Moses, and did not issue in conclusive victory until the time of Ezra, the spiritual faith was compelled to show constant powers of new development—working out into ever-clearer form the latent contrasts between true and false religion, proving itself fitter than any other belief to supply all the religious needs of the people, and, above all, finding its evidence in the long providential history, in which, from the great deliverance of the Exodus down to the Captivity and the Restoration, the reality of Jehovah's kingship over Israel, of his redeeming love, and of his moral government, were vindicated by the most indisputable proofs. As it was only the deliverance from Egypt and the theocratic covenant of Sinai that bound the Hebrew tribes into national unity, the worship of Jehovah was always acknowledged as the national religion of Israel. But from Joshua to Samuel national feeling was far weaker than tribal jealousy; and in the political disintegration of the people the religion of Jehovah seemed ready to be lost in local superstitions. During this period the chief centre of monotheism was the sanctuary and priesthood of the ark; and it was from the priestly circle that Samuel arose to reunite the nation by recalling it to the religion of Jehovah, and thus to prepare the way for the splendid age of David and Solomon. But though Samuel was by education a priest, it was not as a priest, but as a prophet, that he accomplished this work. In all ages a priesthood is conservative, not creative; and it was only as a growing and creative power that the still undeveloped spiritual religion could live. While it was the business of the priest faithfully to preserve religious traditions already acknowledged as true and venerable, the characteristic of the prophet is a

[1] *This article was contributed by Prof. Smith to the new edition of the* Encyclopædia Britannica, *now in course of publication; and for writing it the author has been suspended from the ministry by the Free Church of Scotland, and is to be tried for heresy.* Part II.—The New Testament—will appear in our next Supplement.

faculty of spiritual intuition, not gained by human reason, but coming to him as a word from God himself, wherein he apprehends religious truth in a new light, as bearing in a way not manifest to other men on the practical necessities, the burning questions of the present. Unlike the priesthood, the prophets never formed a regular guild. It was an axiom that the gift of prophecy was bestowed by the inward and immediate call of Jehovah. But from the time of Samuel we find a regular succession of prophets working out the spiritual problems of the national faith with ever-increasing clearness, and gathering round them, sometimes in regularly-formed communities, a circle of disciples and sympathizers which, though never, perhaps, numerically considerable, embraced the names of David and other leaders of Hebrew history, and impressed the stamp of prophetic influence on every part of the national life. From this time the priests hold only the second place in the history of the Old Testament religion; sometimes they even appear as the opponents of the prophetic party, whose progressive ideas are distasteful to their natural conservatism and aristocratic instincts. But, on the whole, the more enlightened ministers of the central sanctuary continued to share with the prophets the task of upholding a lofty religious tradition, and not unfrequently both characters were united in one person. It was, in fact, only through the priests that the ideas of the prophets could receive public sanction in the ordinances of religion, as it was only through rulers like David, or Hezekiah, or Jehu, that they could influence the political conduct of affairs.

A just insight into the work of the prophetic party in Israel was long rendered difficult by traditional prejudices. On the one hand the predictive element in prophecy received undue prominence, and withdrew attention from the influence of the prophets on the religious life of their own time; while, on the other hand, it was assumed, in accordance with Jewish notions, that all the ordinances, and almost, if not quite, all the doctrines of the Jewish church in the post-canonical period, existed from the earliest days of the theocracy. The prophets, therefore, were conceived partly as inspired preachers of old truths, partly as predicting future events, but not as leaders of a great development, in which the religious ordinances as well as the religious beliefs of the Old Covenant advanced from a relatively crude and imperfect to a relatively mature and adequate form.

The proof that this latter view, and not the traditional conception, is alone true to history, depends on a variety of arguments which cannot here be reproduced. That the religious ideas of the Old Testament were in a state of growth during the whole prophetic period became manifest as soon as the laws of grammatico-historical exegesis were fairly applied to the Hebrew Scriptures. That the sacred ordinances were subject to variation was less readily admitted, because the admission involved a change of view as to the authorship of the Pentateuch; but here also the facts are decisive. For example, the law in Exodus xx. 24, *ff.*, contemplates the worship of Jehovah on other altars than that of the central sanctuary (*cf.* Deuteronomy xxxiii. 19). This practice, accordingly, was followed by Samuel, and was fully approved by Elijah (1 Kings xix. 14). But the worship of Jehovah on the high places or local sanctuaries was constantly exposed to superstitious corruption and heathen admixture, and so is frequently attacked by the prophets of the eighth century. It was undoubtedly under their influence that Hezekiah abolished the high places. The abolition was not permanent; but in the reign of Josiah, the next reforming king, we find that the principle of a single sanctuary can claim the support not only of prophetic teaching, but of a written law-book found in the temple, and acknowledged by the high-priest (2 Kings xxii. 23). The legislation of this book corresponds not with the old law in Exodus, but with the book of Deuteronomy. But perhaps the clearest proof that during the period of prophetic inspiration there was no doctrine of finality with regard to the ritual law any more than with regard to religious ideas and doctrines, lies in the last chapters of Ezekiel, which sketch at the very era of the Captivity an outline of sacred ordinances for the future restoration. From these and similar facts, it follows indisputably that the true and spiritual religion which the prophets and like-minded priests maintained at once against heathenism and against unspiritual worship of Jehovah as a mere national deity without moral attributes, was not a finished but a growing system, not finally embodied in authoritative documents, but propagated mainly by direct personal efforts. At the same time these personal efforts were accompanied and supported by the gradual rise of a sacred literature. Though the priestly ordinances were mainly published by oral decisions of the priests, which are, in fact, what is usually meant by the word *law* (Torah) in writings earlier than the Captivity, there can be no reasonable doubt that the priests possessed

written legal collections of greater or less extent from the time of Moses downward. Again, the example of Ezekiel, and the obvious fact that the law-book found at the time of Josiah contained provisions which were not up to that time an acknowledged part of the law of the land, make it probable that legal provisions, which the prophets and their priestly allies felt to be necessary for the maintenance of the truth, were often embodied in legislative programmes, by which previous legal tradition was gradually modified. Then the prophets, especially when they failed to produce immediate reformation, began from the eighth century, if not still earlier, to commit their oracles to writing; and these written prophecies—circulating widely in a nation which had attained a high degree of literary culture, and frequently cited by later seers—disseminated prophetic teaching in a permanent form. Long before this time music and song had been practised in the prophetic circle of Samuel, and were introduced under David into the service of the sanctuary. Another important vehicle of religious instruction was the written history of the nation, which could not fail to be generally set forth in the theocratic spirit in which all loftier Hebrew patriotism had its root. And, indeed, the literary diffusion of spiritual ideas was not confined to the direct efforts of priests and prophets. In spite of the crass and unspiritual character of the mass of the people, the noblest traditions of national life were entwined with religious convictions, and the way in which a prophet, like Amos, could arise untrained from among the herdsmen of the wilderness of Judah, shows how deep and pure a current of spiritual faith flowed among the more thoughtful of the laity. Prophecy itself may, from one point of view, be regarded simply as the brightest efflorescence of the lay element in the religion of Israel, the same element which in subjective form underlies many of the Psalms, and in a shape less highly developed tinged the whole proverbial and popular literature of the nation; for in the Hebrew commonwealth popular literature had not yet sunk to represent the lowest impulses of national life.

Close of the Old Testament Development—Formation of the Canon.—The struggle between spiritual and unspiritual religion was brought to a crisis when the prophetic predictions of judgment on national sin were fulfilled in the fall of the kingdom of Judah. The merely political worship of Jehovah as the tutelary God of the state was now reduced to absurdity. Faith in the covenant God was impossible except on the principles of spiritual belief. Nor did the restoration by Cyrus affect this result. No political future lay before the returning exiles, and continued confidence in the destiny of the race was not separable from the religious ideas and Messianic hopes of the prophets. To obey the law of Jehovah, and patiently to await the coming deliverer, was the only distinctive vocation of the community that gathered in the new Jerusalem; and after a period of misfortune and failure, in which the whole nation seemed ready to collapse in despair, this vocation was clearly recognized and embodied in permanent institutions in the reformation of Ezra and Nehemiah (445 B. C.). But with this victory the spiritual religion passed into a stationary state. The spirit of prophecy, long decadent, expired with Malachi, the younger contemporary of Nehemiah; and the whole concern of the nation from this time downward was simply to preserve the sacred inheritance of the past. The exile had so utterly broken all continuity of national life, that that inheritance could only be sought in the surviving monuments of sacred literature. To these, more than to the expiring voice of prophecy in their midst, the founders of the new theocracy turned for guidance. The books that had upheld the exile's faith, when all outward ordinances of religion were lacking, were also the fittest teachers of the restored community. Previous reformers had been statesmen or prophets. Ezra is a scribe who comes to Jerusalem armed, not with a fresh message from the Lord, but with "the book of the law of Moses." This law-book was the Pentateuch, and the public recognition of it as the rule of the theocracy was the declaration that the religious ordinances of Israel had ceased to admit of development, and the first step toward the substitution of a *canon* or authoritative collection of scriptures for the living guidance of the prophetic voice. A second step in the same direction is ascribed to Nehemiah by a tradition intrinsically probable, though of no great external authority. He, it is said, collected a library which, besides documents of temporary importance, embraced "the books about the kings and prophets, and the writings of David" (2 Maccabees ii. 13). Certainly a complete body of the remains of the prophets, with an authentic account of the history of the period of their activity, must soon have been felt to be scarcely second in importance to the law; and so Nehemiah may very well be supposed to have begun the collection which now forms the second part of the Hebrew

Bible, embracing, under the general title of *the Prophets*, the historical books of Joshua, Judges, Samuel, Kings (*earlier Prophets*), and the four prophetic books of Isaiah, Jeremiah, Ezekiel, and of the twelve minor prophets (*latter Prophets*). The mention of the writings of David implies that Nehemiah also began the formation of the third and last part of the Hebrew canon, which comprises, under the title of *Ketubim* (Scriptures, Hagiographa), the Psalms, Proverbs, Job, the five Megillot or *rolls* (Canticles, Ruth, Lamentations, Ecclesiastes, Esther); and, finally, Daniel, Ezra, Nehemiah, and Chronicles. It is certain, however, that this part of the collection was not completed till long after Nehemiah's time; for to say nothing of the disputed dates of Ecclesiastes and Daniel, the book of Chronicles contains genealogies which go down at least to the close of the Persian period. The miscellaneous character of the Ketubim seems, in fact, to show that, after the Law and the Prophets were closed, the third part of the canon was open to receive additions, recommended either by their religious and historical value, or by bearing an ancient and venerable name. And this was the more natural because the Hagiographa had not the same place in the synagogue service as was accorded to the Law and the Prophets.

The time and manner in which the collection was absolutely closed is obscure. The threefold division of the sacred writings is referred to in the "Prologue to the Wisdom of Sirach" (Ecclesiasticus) about 130 B. C., but Jewish tradition indicates that the full canonicity of several books, especially of Ecclesiastes, was not free from doubt till the time of the famous R. Akiba, who perished in the great national struggle of the Jews with the Emperor Hadrian (Mishna, *Jadaim*, 3; *Edaiot*, 5). The oldest list of canonical books, given by Josephus (c. Apion., 1. 8), is of somewhat earlier date. Josephus seems to have had quite our present canon; but he took Ruth along with Judges, and viewed Lamentations as part of the book of Jeremiah, thus counting twenty-two books instead of the twenty-four of the Talmudic enumeration, and of the present Hebrew Bible. There is other evidence that only twenty-two books were reckoned by the Jews of the first Christian century; and it appears that this number was accommodated to that of the letters of the Hebrew alphabet. Even in the time of Jerome, Ruth and Lamentations were not uniformly reckoned apart. The expansion of the Talmudic twenty-four to the thirty-nine Old Testament books of the English version is effected by reckoning the minor prophets one by one, by separating Ezra from Nehemiah, and by subdividing the long books of Samuel, Kings, and Chronicles. In this reckoning, and in the very different order of the books, we follow, in the main, the Alexandrian Greek and Vulgate Latin versions. But the Alexandrian differed from the Hebrew canon in more important points. The line of distinction between inspired and human writings was not so sharply drawn, and the Greek Bible not only admitted additions to several of the Hagiographa, but contained other apocryphal books, of some of which Greek was the original tongue, while others were translations of Hebrew or Aramaic writings.

In turning now to a literary and critical survey of the Old Testament books, we shall find it convenient to depart from the division of the Hebrew canon in favor of a classification suggested by the order of the books followed in the English version and in most other translations. The Old Testament literature is made up of historical, poetico-didactic, and prophetic writings, and under these three heads we will arrange what remains to be said on the subject.

Historical Books.—These form two parallel series of sacred history. The books from Genesis to Kings give a continuous story (with some episodical additions) from the creation to the fall of the kingdom of Judah. The book of Chronicles covers the same ground on a narrower plan, contracting the early history into genealogical lists, and occupying itself almost entirely with the kingdom of Judah, and especially with matters connected with the temple and its worship. The narrative of the chronicler is continued in the books or, rather, book of Ezra and Nehemiah, which incorporates original memoirs of these two reformers, but otherwise is so exactly in the style of the Chronicles that critics are practically agreed in ascribing the whole to a single author, probably a Levite, who, as we have already seen, cannot have written before the close of the Persian Empire. The questions that are raised as to the work of the chronicler belong less to the general history of Biblical literature than to special introduction; we pass on, therefore, to the larger and more important series. The Pentateuch and the so-called earlier prophets form together a single continuous narrative. It is plain, however, that the whole work is not the uniform production of one pen, but that, in some way, a variety of records of different ages and styles have been combined to form a single narrative. Accordingly, Jewish tradition bears testimony that Moses wrote the

Pentateuch, Joshua the book named after him, Samuel the book of Judges, and so forth. As all Hebrew history is anonymous—a sure proof that people had not yet learned to lay weight on questions of authorship—it is not probable that this tradition rests on any surer ground than conjecture; and, of course, a scribe who saw in the sacred books the whole outcome of Israel's history would naturally leap to the conclusion that the father of the Law was the author of the Pentateuch, and that the other leaders of Israel's history could not but be the writers of a great part of the Scriptures. A more careful view of the books themselves shows that the actual state of the case is not so simple. In the first place, the limits of the individual books are certainly not the limits of authorship. The Pentateuch, as a law-book, is complete without Joshua, but as a history it is so planned that the latter book is its necessary complement (*cf.*, for example, Exodus xvi. 35; Joshua v. 12; Genesis i. 24, 25; Exodus xiii. 19; Joshua xxiv. 32). In truth, an author who wrote after the occupation of Canaan could never have designed a history which should relate all God's promises to Israel, and say nothing of their fulfillment. But, in its present shape, the Pentateuch is certainly subsequent to the occupation, for it uses geographical names which arose after that time (Hebron, Dan), refers to the conquest as already accomplished (Deuteronomy ii. 12, *cf.* Numbers xv. 32; Genesis xii. 6), and even presupposes the existence of a kingship in Israel (Genesis xxxvi. 31). And with this it agrees that, though there are marked differences of style and language within the book of Joshua, each style finds its counterpart in some section of the Pentateuch. In the subsequent books we find quite similar phenomena. The last chapters of Judges cannot be separated from the book of Samuel, and the earlier chapters of Kings are obviously one with the foregoing narrative; while all three books contain passages strikingly akin to parts of the Pentateuch and Joshua (*cf.*, for example, the book of Deuteronomy with Joshua xxiii., 1 Samuel xii., 1 Kings viii.). Such phenomena not only prove the futility of any attempt to base a theory of authorship on the present division into books, but suggest that the history as we have it is not one narrative carried on from age to age by successive additions, but a fusion of several narratives which partly covered the same ground and were combined into unity by an editor. This view is supported by the fact, that even as it now stands the history sometimes gives more than one account of the same event, and that the Pentateuch often gives several laws on the same subject. Of the latter we have already had one example, but for our present argument the main point is not diversity of enactment, which may often be only apparent, but the existence within the Pentateuch of distinct groups of laws partly taking up the same topics. Thus the legislation of Exodus xx.–xxiii. is partly repeated in chapter xxxiv., and on the passover and feast of unleavened bread we have at least six laws, which, if not really discordant, are at least so divergent in form and conception that they cannot be all from the same pen (Exodus xii. 1–28; xiii. 3–10; xxiii. 15; xxxiv. 18; Leviticus xxiii. 5–14; Deuteronomy xvi.). Of historical duplicates the most celebrated are the twofold history of the creation and the flood, to which we must recur presently. The same kind of thing is found in the later books; for example, in the account of the way in which Saul became king, where it is scarcely possible to avoid the conclusion that 1 Samuel xi. 1–11 should attach directly to chapter x. 16 (*cf.* x. 7). But the extent to which the historical books are made up of parallel narratives which, though they cover the same period, do not necessarily record the same events, was first clearly seen after Astruc (1753 A. D.) observed that the respective uses of Jehovah (Lord) and Elohim (God) as the name of the Deity afford a criterion by which two documents can be dissected out of the book of Genesis. That the way in which the two names are used can only be due to difference of authorship is now generally admitted, for the alternation corresponds with such important duplicates as the two accounts of creation, and is regularly accompanied through a great part of the book by unmistakable peculiarities of language and thought, so that it is still possible to reconstruct at least the Elohim document with a completeness which makes its original independence and homogeneity matter of direct observation. The character of this narrative is annalistic; and, where other material fails, blanks are supplied by genealogical lists. Great weight is laid on orderly development, and the name Jehovah is avoided in the history of the patriarchs in order to give proper contrast to the Mosaic period (*cf.* Genesis xvii. 1; Exodus vi. 3); and, accordingly, we find that the unmistakable secondary marks of this author run through the whole Pentateuch and Joshua, though the exclusive use of Elohim ceases at Exodus vi. Of course the disappearance of this criterion makes it less easy to carry

on an exact reconstruction of the later parts of the document; but on many points there can be no uncertainty, and it is clearly made out that the author has strong priestly tendencies, and devotes a very large proportion of his space to liturgical matters. The separation of this document may justly be called the point of departure of positive criticism of the sources of the Old Testament; and present controversy turns mainly on its relation to other parts of the Pentateuch. Of these the most important are—1. The Jehovistic narrative, which also begins with the creation, and treats the early history more in the spirit of prophetic theology and idealism; containing, for example, the narrative of the fall, and the parts of the history of Abraham which are most important for Old Testament theology. That this narrative is not a mere supplement to the other, but an independent whole, appears most plainly in the story of the flood, where two distinct accounts have certainly been interwoven by a third hand. 2. Many of the finest stories in Genesis, especially great part of the history of Joseph, agree with the Elohim document in the name of God, but are widely divergent in other respects. Since the researches of Hupfeld, a third author, belonging to northern Israel, and specially interested in the ancestors of the northern tribes, is generally postulated for these sections. His literary individuality is, in truth, sharply marked, though the limits of his contributions to the Pentateuch are obscure.

It will be remembered that we have already seen that three currents of influence run through the Old Testament development—the traditional lore of the priests, the teaching of the prophets, and the religious life of the more enlightened of the people. Now, in the three main sections of the early history just enumerated we find the counterpart of each of these. The priestly narrative of the Elohist, the prophetic delineation of the Jehovist, the more picturesque and popular story of the third author, embody three tendencies, which are not merely personal but national, and which constantly reappear in other parts of Hebrew literature. Up to the book of Joshua all three run side by side. But the priestly interest found little scope in the subsequent history; and from the time of the Judges we can generally distinguish only sections marked by prophetic pragmatism, and others which, though distinctly religious and even theocratic, are, so to speak, written from a layman's standpoint. The latter comprise a large part of Judges, and by far the greatest part of Samuel, as well as the beginning of Kings. To the modern mind this part of the narrative, which is rich in color and detail, is by far the most interesting, and it is with sincere regret that we pass at 1 Kings xi. to a division of the history for which the chief sources—cited as the Chronicles of the Kings of Israel and Judah respectively—treat almost exclusively of the outer political life of the nation. In striking contrast to the uniformity of this narrative are the interspersed histories of Elijah and other northern prophets. These histories are very remarkable in style and even in language; and, containing some of the noblest passages of the Old Testament, form one of many proofs of the unusual literary genius of the kingdom of Ephraim. But how are these various narratives related to each other? This question is not easy to answer. In general, the third or lay element of the history seems to stand nearest to the events recorded, and even, perhaps, to form the direct basis of the prophetical matter; while, occasionally, old lists of names and places, poetico-historical pieces, and the like, form a still deeper stratum in the story (poetical pieces in the *book of the wars of Jehovah*, Numbers xxi. 14; *book of Jasher* [the upright], Joshua x. 13; 2 Samuel i. Lists like 2 Samuel xxiii.). Whether the same hands or only the same tendencies as appear in the non-Levitical parts of Genesis run on as far as the book of Kings, is a question which, though answered in the affirmative by Schrader and others, cannot be viewed as decided. Even the date of these elements of the Pentateuch is obscure; but, in the eighth century Hosea refers quite clearly to passages of both. Thus far there is tolerable agreement among critics; but the Levitical or Elohistic history is the subject of violent controversy, which, however, turns mainly on the analysis of the legal parts of the Pentateuch. These contain other elements besides those already enumerated, of which we need only mention the brief code which follows the Decalogue in Exodus xx.–xxiii., and the great repetition of the law in a prophetic spirit which occupies the major part of Deuteronomy. Both these codes may be called popular in tone. They are precepts not for the priests, but for the whole people; and the former is the fundamental sketch of the whole theocratic constitution, which the latter develops and to some extent alters. Now, the book of Deuteronomy presents a quite distinct type of style which, as has been already mentioned, recurs from time to time in passages of the later books, and that in such a connection as to suggest to many critics since

Graf the idea that the Deuteronomic hand is the hand of the last editor of the whole history from Genesis to Kings, or, at least, of the non-Levitical parts thereof. This conclusion is not stringent, for a good deal may be said in favor of the view that the Deuteronomic style, which is very capable of imitation, was adopted by writers of different periods. But even so it is difficult to suppose that the legislative part of Deuteronomy is as old as Moses. If the law of the kingdom in Deuteronomy xvii. was known in the time of the Judges, it is impossible to comprehend Judges viii. 23, and, above all, 1 Samuel viii. 7. That the law of high places given in this part of the Pentateuch was not acknowledged till the time of Josiah, and was not dreamed of by Samuel and Elijah, we have already seen. The Deuteronomic law is familiar to Jeremiah, the younger contemporary of Josiah, but is referred to by no prophet of earlier date. And the whole theological standpoint of the book agrees exactly with the period of prophetic literature, and gives the highest and most spiritual view of the law, to which our Lord himself directly attaches his teaching, and which cannot be placed at the beginning of the theocratic development without making the whole history unintelligible. Beyond doubt the book is, as already hinted, a prophetic legislative programme; and, if the author put his work in the mouth of Moses instead of giving it, with Ezekiel, a directly prophetic form, he did so, not in pious fraud, but simply because his object was not to give a new law, but to expound and develop Mosaic principles in relation to new needs. And, as ancient writers are not accustomed to distinguish historical data from historical deductions, he naturally presents his views in dramatic form in the mouth of Moses. If, then, the Deuteronomic legislation is not earlier than the prophetic period of the eighth and seventh centuries, and, accordingly, is subsequent to the elements of the Pentateuchal history which we have seen to be known to Hosea, it is plain that the chronology of the composition of the Pentateuch may be said to centre in the question whether the Levitico-Elohistic document, which embraces most of the laws in Leviticus with large parts of Exodus and Numbers, is earlier or later than Deuteronomy. The answer to this question turns almost wholly on archæological inquiries, for there is, perhaps, no *quite* conclusive reference to the Elohistic record in the prophets before the Exile, or in Deuteronomy itself. And here arises the great dispute which divides critics, and makes our whole construction of the origin of the historical books uncertain. The Levitical laws give a graduated hierarchy of priests and Levites; Deuteronomy regards all Levites as at least possible priests. Round this difference, and points allied to it, the whole discussion turns. We know, mainly from Ezekiel xliv., that before the Exile the strict hierarchical law was not in force, apparently never had been in force. But can we suppose that the very idea of such a hierarchy is the latest point of liturgical development? If so, the Levitical element is the latest thing in the Pentateuch, or, in truth, in the historical series to which the Pentateuch belongs; or, on the opposite view, the hierarchic theory existed as a legal programme long before the Exile, though it was fully carried out only after Ezra. As all the more elaborate symbolic observances of the ritual law are bound up with the hierarchical ordinances, the solution of this problem has issues of the greatest importance for the theology as well as for the literary history of the Old Testament.

And now a single word on the way in which these various elements, mirroring so many sides of the national life, and dating from so various ages, came to be fused into a single history, and yet retained so much of their own identity. The Semitic genius does not at all lie in the direction of organic structure. In architecture, in poetry, in history, the Hebrew adds part to part instead of developing a single notion. The temple was an aggregation of small cells, the longest Psalm is an acrostic, and so the longest Biblical history is a stratification and not an organism. This process was facilitated by the habit of anonymous writing, and the accompanying lack of all notion of anything like copyright. If a man copied a book it was his to add and modify as he pleased, and he was not in the least bound to distinguish the old from the new. If he had two books before him to which he attached equal worth, he took large extracts from both, and harmonized them by such additions or modifications as he felt to be necessary. But in default of a keen sense for organic unity very little harmony was sought in points of internal structure, though great skill was often shown, as in the book of Genesis, in throwing the whole material into a balanced scheme of external arrangement. On such principles minor narratives were fused together one after the other, and at length in exile a final *rédacteur* completed the great work, on the first part of which Ezra based his reformation, while the latter part was thrown into the second canon. The curious combina-

tion of the functions of copyist and author which is here presupposed did not wholly disappear till a pretty late date; and where, as in the books of Samuel, we have two recensions of the text, one in the Hebrew and one in the Septuagint translation, the discrepancies are of such a kind that criticism of the text and analysis of its sources are separated by a scarcely perceptible line.

Poetical Books.—The origin of some leading peculiarities of Hebrew poetry has been recently referred to by Assyriologists to Accadian models; but, however this may be, the key to the whole development of the poetical literature of Israel is found in the same psychological characteristics of the race which are impressed on the vocabulary and grammatical structure of the language. The Hebrew tongue is sensuous, mobile, passionate, almost incapable of expressing an abstract idea, or depicting a complex whole with repose and symmetry of parts, but fit to set forth with great subtilty individual phases of Nature or feeling. It is the speech of a nation whose naturally quick perceptions minister to an emotional temperament and an imperious will, which subordinates knowledge to action and desire, and habitually contemplates the universe through the medium of personal feeling or practical purpose. To speak with the philosophers, the Hebrew character is one of predominant subjectivity, eager to reduce everything to a personal standard, swift to seize on all that touches the feelings or bears directly on practical wants, capable of intense effort and stubborn persistence where the motive to action is personal affection or desire, but indisposed to theoretical views, unfit for contemplation of things as they are in themselves apart from relation to the thinker. In the poetry of such a nation the leading current must necessarily be lyrical, for the lyric is the natural vehicle of intense and immediate personal feeling. The earliest Hebrew poems are brief, pregnant expressions of a single idea, full of the fire of passion, full, too, of keen insight into Nature, in her power to awake or sustain human emotion; but recording this insight not with the pictorial fullness of Western art, but in swift, half-formed outlines, in metaphor piled on metaphor, without regard to any other principle of proportion or verisimilitude than the emotional harmony of each broken figure with the dominant feeling. Such a poetry could not but find its highest scope in the service of spiritual religion. The songs in Exodus xv. and Judges v. prove the early origin of a theocratic poetry; but the proper period of Hebrew psalmody begins with David, and its history is practically the history of the Psalter. Here, as in the case of the historical books, we have to begin by questioning the tradition contained in the titles, which ascribe seventy-three Psalms to David, and besides him name as authors Asaph, the sons of Korah, Solomon, Moses, Heman, Ethan. Again the tendency is to refer as much as possible to familiar names. There is no reason to believe that any title is as old as the Psalm to which it is prefixed, and some titles are certainly wrong; for example, the author of the elegy on Saul and Jonathan could not possibly have written Psalm lxxxvi., which is a mere cento of reminiscences from other poems. On the other hand, the titles are not purely arbitrary. They seem to supply useful hints as to the earlier collections from which our present Psalter was made up. The Korahite and Asaphite Psalms may probably have been derived from collections in the hands of these families of singers; and the so-called "Psalms of David" were very likely from collections which really contained poems by David and other early singers. The assertion that no Psalm is certainly David's is hyper-skeptical, and few remains of ancient literature have an authorship so well attested as the eighteenth or even as the seventh Psalm. These, along with the indubitably Davidic poems in the book of Samuel, give a sufficiently clear image of a very unique genius, and make the ascription of several other poems to David extremely probable. So, too, a very strong argument claims Psalm ii. for Solomon, and in later times we have sure landmarks in the Psalms of Habakkuk (Habakkuk iii.) and Hezekiah (Isaiah xxxviii.). But the greater part of the lyrics of the Old Testament remain anonymous, and we can only group the Psalms in broad masses, distinguished by diversity of historical situation and by varying degrees of freshness and personality. As a rule the older Psalms are the most personal, and are not written for the congregation, but flow from a present necessity of individual (though not individualistic) spiritual life. This current of productive psalmody runs apparently from David down to the Exile, losing in the course of centuries something of its original freshness and fire, but gaining a more chastened pathos and a wider range of spiritual sympathy. Psalm li., obviously composed during the desolation of the temple, marks, perhaps, the last phase of this development. The epoch of the return was still not without poetic freshness, as some of the so-called "Songs of Degrees" (Pilgrim Songs?) prove. But on the whole the Psalms of the second temple are only reflections of old ideas, cast

mainly in directly liturgical form, or at least embodying the experience of the nation rather than of the individual. The date of the latest Psalms is much disputed. Most lines of evidence suggest that the collection was complete before the latest books of the canon were written, but many expositors find in individual Psalms (xliv., lxxiv., lxxix., lxxxiii., etc.) clear traces of the Maccabee age.

Through the whole period of Hebrew lyric poetry, represented not only by the Psalter, but by the Lamentations, traditionally ascribed to Jeremiah, and by various scattered pieces in Prophets (*e. g.*, Isaiah xii.) and in historical books (*e. g.*, Numbers xxi. 17; 1 Samuel ii.), there is little change in form and poetic structure. From first to last the rhythm consists not in a rise and fall of accent or quantity of syllables, but in a pulsation of sense, rising and falling through the parallel, antithetic, or otherwise balanced members of each verse (so-called *Hebrew parallelism;* better, *sense-rhythm*). Beyond this one law of rhythm, which is itself less an artificial rule than a natural expression of the principle, that all poetic utterance must proceed in harmonious undulation, and not in the spasm of unmodulated passion, the Hebrew poet was subject to no code of art, though strophical arrangements, sometimes marked by a refrain, are not uncommon; while poems of acrostic structure (alphabetic Psalms) are found not exclusively in the most recent literature (Psalms ix., x., form a single undoubtedly old acrostic). The later are on the whole longer than the earlier poems. But this is due not to increased constructive power, but to a diffuser style, a less vigorous unity of feeling and thought, and a tendency to ring many variations on one key. A wider range of artistic power appears in the Song of Solomon, a lyrical drama, in which, according to most critics, the pure love of the Shulamite for her betrothed is exhibited as victorious over the seductions of Solomon and his harem. As the motive of the piece is political as well as ethical, it is most naturally assigned to the early period of the northern kingdom.

The remaining poetical books of the Old Testament belong to a different category. Unfit for abstract speculation, valuing no wisdom that is not practical, and treasuring up such wisdom in sententious rhythmical form—enforced by symbol and metaphor, and warm with the breath of human interest—the Hebrew is a poet even in his philosophy. Side by side with the ode the earliest Hebrew literature shows us the Mashal, or *similitude*, sometimes in the form of biting epigram (Numbers xxi. 27, *ff.*) or sarcastic parable (Judges ix. 8; 2 Kings xiv. 8), sometimes as the natural vehicle of general moral teaching. The greatest name in the early proverbial wisdom of Israel is that of Solomon (1 Kings iv. 32), and, beyond doubt, many of his aphorisms are to be found in the book of Proverbs. Yet this book is not all Solomonic. The last two chapters are ascribed to other names, and part of the collection was not put in shape till the time of Hezekiah (xxv. 1), who can have had no infallible criterion of authorship by Solomon, and must not be credited with critical intentions. In truth, the several sections of the book are varied enough in color to make it plain that we have before us the essence of the wisdom of centuries, while the introductory address in chapters i.–ix. shows how a later age learned to develop the gnomic style, so as to fit it for longer compositions. The fundamental type of Hebrew philosophy remains, however, unchanged, even in the book of Ecclesiastes, which bears every mark of a very late date, long after the Exile. On the other hand a fresh and creative development, alike in point of form and of thought, is found in the book of Job, which, in grandly dramatic construction, and with wonderful discrimination of character in the several speakers, sums up the whole range of Hebrew speculation on the burning question of Old Testament religion, the relation of affliction to the justice and goodness of God and to the personal merit and demerit of the sufferer. Like the other noblest parts of the Old Testament, the book of Job has a comparatively early date. It was known to Jeremiah, and may be plausibly referred to the seventh century B. C.

In the book of Job we find poetical invention of incidents, attached for didactic purposes to a name apparently derived from old tradition. There is no valid *a priori* reason for denying that the Old Testament may contain other examples of the same art. The book of Jonah is generally viewed as a case in point. Esther, too, has been viewed as a fiction by many who are not over-skeptical critics; but, on this view, a book which finds no recognition in the New Testament, and whose canonicity was long suspected by the Christian, as well as by the Jewish Church, must sink to the rank of an apocryphal production.

In the poetical, as in the historical books, anonymous writing is the rule; and, along with this, we observe great freedom on the part of readers and copyists, who not only made verbal changes (*cf.* Psalm xiv. with Psalm liii.), but composed new poems out of fragments of others (Psalm cviii. with lvii. and lx.). In a large part

of the Psalter a later hand has systematically substituted Elohim for Jehovah, and an imperfect acrostic, like Psalms ix., x., cannot have proceeded in its present form from the first author. Still more remarkable is the case of the book of Job, in which the speeches of Elihu quite break the connection, and are almost universally assigned to a later hand.

Prophetical Books.—We have already seen that the earliest prophecies of certain date are of the eighth century, though there is a probability that Joel flourished in the ninth century, in the reign of Joash of Judah, and that the opening verses of Amos are cited from his book. On the other hand, the old school of prophecy, whose members, from Samuel to Elisha, were men of action rather than of letters, was not likely to leave behind it any written oracles. The prophets generally spoke under the immediate influence of the spirit or "hand of Jehovah." What they wrote was secondary, and was, no doubt, greatly abridged. The most instructive account of the literary activity of a prophet is given in Jeremiah xxxvi. Jeremiah did not begin to write till he had been more than twenty years a prophet. Some prophetic books, like that of Amos, seem to have been composed at one time and with unity of plan. Other prophets, like Isaiah, published several books summing up portions of their ministry. In one or two cases, especially in that of Ezekiel, the prophet writes oracles which were apparently never spoken. Before the Exile there was circulation of individual prophetic books, and earlier prophets quote from their predecessors. But the task of collecting and editing the remains of the prophets was hardly undertaken till the commencement of the second canon; and by this time, no doubt, many writings had been lost, others were more or less fragmentary, and the tradition of authorship was not always complete. It was, indeed, more important to have an oracle authenticated by the name of its author than to know the writer of a history or a psalm, and many prophets seem to have prefixed their names to their works. But other prophecies are quite anonymous, and prophets who quote earlier oracles never give the author's name. (A famous case occurs, Isaiah xv., xvi, where in xvi. 13, for *since that time*, read *long ago*.) Now, all the remains of prophecy, whether provided with titles or not, were ultimately arranged in four books, the fourth of which names, in separate titles, twelve authors; while the first three books are named after Isaiah, Jeremiah, Ezekiel, and actually mention no other names in the titles of the several prophecies of which they are made up. But is it safe to assume that every anonymous prophecy in these books must be by the author of the next preceding prophecy which has a title? Certainly any such assumption can only be provisional, and may be overthrown by internal evidence. But internal evidence of date, it is said, cannot apply to prophetic books in which the author looks in a supernatural way into the future. The value of this argument must be tested by looking more closely at the actual contents of the prophetic books. The prophecies contain: 1. Reproof of present sin; 2. Exhortation to present duty; 3. Encouragement to the godly and threatening to the wicked, based on the certainty of God's righteous purpose. In this last connection prophecy is predictive. It lays hold of the ideal elements of the theocratic conception, and depicts the way in which, by God's grace, they shall be actually realized in a Messianic age, and in a nation purified by judgment and mercy. But in all this the prophet starts from present sin, present needs, present historical situations. There is no reason to think that a prophet ever received a revelation which was not spoken directly and pointedly to his own time. If we find, then, that, after the prophecy of Zechariah i.–viii., which is complete in itself, there begins at chapter ix. a *new* oracle, quite distinct in subject and style, which speaks of an alliance between Judah and Israel as a thing subsisting in the prophet's own time, which knows no oppressor later than Assyria and Egypt, and rebukes forms of idolatry that do not appear after the Exile; if, in short, the whole prophecy becomes luminous when it is placed a little after the time of Hosea, and remains absolutely dark if it is ascribed to Zechariah—we are surely entitled to let it speak for itself. When the principle is admitted, other applications follow, mainly in the book of Isaiah, where the anonymous chapters xl.–lxvi. cannot be understood in a natural and living way except by looking at them from the historical standpoint of the Exile. Then arises a further question whether all *titles* are certainly authentic and conclusive; and here, too, it is difficult to answer by an absolute affirmative. For example, in Isaiah xxx. 6 the title, "The burden of the beasts of the south," interrupts the connection in a most violent way. This is not a solitary instance, but, on the whole, the titles are far more trustworthy in the prophecies than in the Psalms, and partly on this account, but mainly from the direct historical bearing of prophetic teaching, we can frame a com-

pleter history of written prophecy than of any other part of Old Testament literature. We have, on the one hand, a series of prophets—Amos, Hosea, and the anonymous author of Zechariah ix.–xi.—who preached in the northern kingdom, but are not descendants of the school of Elisha, which had so decayed under court favor from the dynasty of Jehu that Amos had to be sent from the wilderness of Judah to take up again the forgotten Word of the Lord. In Judah proper we have the great Assyrian prophets, Isaiah, with his younger contemporary Micah, the powerful supporters of the reformation of Hezekiah, laboring, one in the capital, the other in the country district of the Philistine border. To the Assyrian period belongs also Nahum, who wrote, perhaps, in captivity, and foretold the fall of Nineveh. Then comes Zephaniah, about the time of the Scythian ravages, followed by the prophets of the Chaldean period, first Habakkuk, and then Jeremiah and Ezekiel, men of a heavier spirit and less glowing poetic fire than Isaiah, no longer upholding the courage of Judah in the struggle with the empire of the East, but predicting the utter dissolution of existing things, and finding hope only in a new covenant—a new theocracy. In the period of Exile more than one anonymous prophet raised his voice; for not only the "Great Unnamed" of Isaiah xl.–lxvi., but the authors of other Babylonian prophecies, are probably to be assigned to this time. In the new hope of deliverance, the poetic genius, as well as the spiritual insight of prophecy, awakes to fresh life, and sets forth the mission of the new Israel to carry the knowledge of the Lord to all nations. But the spirit of the new Jerusalem had little in common with these aspirations; and in Haggai, Zechariah, and Malachi, prophecy retains not much of its old power, except an uncompromising moral earnestness. The noble poetry of the old prophets, which even in the time of Ezekiel had begun to give way to plain prose, finds no counterpart in these latest oracles; and imaginative power is shown, where it still exists, in the artificial structure of symbolic visions. No important new ideas are set forth, and even the tone of moral exhortation sometimes reminds us more of the rabbinical maxims of the fathers in the Mishna than of the prophetic teaching of the eighth century. And, as if the spirit of prophecy foresaw its own dissolution, Malachi looks not to the continued succession of prophets, but to the return of Elijah, as the necessary preparation for the day of the Lord. In this sketch of the prophetic writings we find no place for the book of Daniel, which, whether composed in the early years of the Persian Empire, or, as modern critics hold, at the time of the Maccabee wars, presents so many points of diversity from ordinary prophecy as to require entirely separate treatment. It is in point of form the precursor of the apocalyptic books of post-canonical Judaism, though in its intrinsic qualities far superior to these, and akin to the prophets proper.

Further History of the Old Testament Canon in the Jewish Church.—Under this head we confine ourselves to points which lead up to the reception of the Old Testament by Christendom. These are mainly two: 1. The history of the Hebrew text, which we now possess only in the recension established by Jewish scribes at a time later than the Christian era; 2. The history of those versions which arose among Jews, but have influenced Christendom.

The Text of the Old Testament.—Semitic alphabets have no full provision for distinguishing vowels; and the oldest writing, before orthography became fixed, was negligent in the use even of such vowel-letters as exist. For a long time, then, not only during the use of the old Phœnician character, but even after the more modern square or Babylonian letters were adopted, the written text of the Bible was *consonantal only*, leaving a certain scope for variety of pronunciation and sense. But even the consonantal text was not absolutely fixed. The loose state of the laws of spelling, and the great similarity of several letters, made errors of copying frequent. The text of Micah, for example, is often unintelligible, and many hopeless errors are older than the oldest versions. But, up to the time of the Alexandrian version, MSS. were in circulation which differed not merely by greater or less accuracy of transcription, but by presenting such differences of recension as could not arise by accident. The Greek text of Jeremiah is vastly different from that of the Hebrew Bible, and it is not certain that the latter is always best. In the books of Samuel the Greek enables us to correct many blunders of the Hebrew text, but shows at the same time that copyists used great freedom with details of the text. For the Pentateuch we have, in the copies of the Samaritans, a third recension, often but not always closely allied to the Greek. The three recensions show important variations in the chronology of Genesis; and it is remarkable that the *book of Jubilees*, a Jewish treatise, which cannot be much older than the Christian era, perhaps not much older than the destruction of the Jewish state, sometimes agrees

with the Samaritan or with the Alexandrian recension. Up to this time, then, there was no absolutely received text. But soon after the Christian era all this was changed, and, by a process which we cannot follow in detail, a single recencion became supreme. The change was, no doubt, connected with the rise of an overdrawn and fantastic system of interpretation, which found lessons in the smallest peculiarity of the text; but Lagarde has made it probable that no critical process was used to fix the standard recension, and that all existing MSS. are derived from a single archetype, which was followed even in its marks of deletion and other accidental peculiarities (Lagarde, *Anmerkungen zur griech. Uebersetzung der Prov.*, 1863, p. 1; *cf.* Nöldeke in Hilgenfeld's *Zeitschr.*, 1873, p. 445). Then the received text became the object of further care, and the Masorets, or "possessors of tradition," with regard to the text, handed down a body of careful directions as to the true orthography and pronunciation. The latter was fixed by the gradual invention of subsidiary marks for the vowels, etc., an invention developed in slightly divergent forms in the Babylonian and Palestinian schools of Jewish scholarship. The vowel-points were not known to Jerome, but the system was complete before the ninth century, presumably several hundred years before that time. All printed Bibles follow the Western punctuation, but old Karaite MSS., with the Babylonian vowels, exist, and are now in course of publication. It is from the Masoretic text, with Masoretic punctuation, that the English version and most Protestant translations are derived. Older Christian versions, so far as they are based on the Hebrew at all (Jerome's Latin, Syriac), at least follow pretty closely the received consonantal text.

Jewish Versions.—Versions of the Old Testament became necessary partly because the Jews of the Western Dispersion adopted the Greek language, partly because even in Palestine the Old Hebrew was gradually supplanted by Aramaic. The chief seat of the Hellenistic Jews was in Egypt, and here arose the Alexandrian version, commonly known as the Septuagint or version of the LXX., from a fable that it was composed, with miraculous circumstances, by seventy-two Palestinian scholars summoned to Egypt by Ptolemy Philadelphus. In reality there can be no doubt that the version was gradually completed by several authors and at different times. The whole is probably older than the middle of the second century B. C. We have already seen that the text that lay before the translators was in many parts not that of the present Hebrew. The execution is by no means uniform, and, though there are many good renderings, the defects are so numerous that the Greek-speaking Jews, as well as the large section of the Christian Church which long depended directly or indirectly on this version, were in many places quite shut out from a right understanding of the Old Testament. Nevertheless, the authority of the version was very great, its inspiration was often asserted, and its interpretations exercised a great influence on Jewish and Christian thought, though among the Jews it was to a certain extent displaced by the version of the proselyte Aquila (second century of our era), which followed with slavish exactness the letter of the Hebrew text.

Among the Jews who spoke Aramaic, translations into the vernacular accompanied, instead of supplanting, the use of the original text, which was read and then orally paraphrased in the synagogues by interpreters or Methurgemanim, who used great freedom of embellishment and application. This practice naturally led to the formation of written Targums, or Aramaic translations, which have not, however, reached us in at all their earliest form. It used, indeed, to be supposed that the simple and literal Targum of Onkelos on the Pentateuch was earlier than the time of Christ. But recent inquirers have been led to see in it, and in the linguistically cognate Targum on the Prophets (Targum of Jonathan), products of the Babylonian schools, in which the freedom of the early paraphrastic method was carefully avoided. Upon this view the date of these Targums is some centuries after the Christian era. On the other hand, an older style of paraphrase is preserved in the Palestinian Targums, which nevertheless contain in their present form elements later than the Babylonian versions. The Targum of Pseudo-Jonathan on the Pentateuch is apparently the latest form of the free Palestinian version, full of legendary adornments and other additions to the text. Other fragments of Palestinian translation, known as the Jerusalem Targum, and referring to individual passages of the Pentateuch and Prophets, probably represent an earlier stage in the growth of the Aramaic versions. There are also Targums on the Hagiographa, which, however, have less importance, and do not seem to have had so changeful a history. The Targums as a whole do not offer much to the textual critic. They are important, partly from the insight they give into an early and in part pre-Christian exegesis, partly from their influence on later Jewish expositors,

and through them on Christian versions and expositions. In some cases the literal or Babylonian Targums have a text differing from the Masoretic. But it is not unlikely that, if we had a satisfactory text of the Targums (toward which almost nothing has hitherto been done), these variations would find their explanation in the Eastern text and the Assyrian punctuation.

ANOTHER LESSON FROM THE RADIOMETER.

By WILLIAM CROOKES, F. R. S.

THE great aim of the writer who criticises or popularizes scientific discoveries should be accuracy. He who misrepresents, and then refutes, not what has been really advanced by the author, but what has been foisted upon him, lays himself open to the gravest censure. The business of the critic is to investigate, to digest, and then to describe, briefly perhaps, but so as not to lead astray. If there are before him errors of fact, let them be pointed out; if false conclusions, let them be refuted. No mistake in doctrine or method, in matter or manner, should be passed over. On the other hand, the critic should remember that experimental research is necessarily and slowly progressive, and that the early provisional hypothesis has to be modified, adjusted, perhaps altogether abandoned, in deference to later observations. We do not censure the dawn for not being full daylight, nor should an author's more advanced researches be used to condemn and to discredit his first gropings after truth.

In an "age of research" it is of consequence, too, that the work of critical examination should be intrusted to competent hands. And who should interpret to the public the results of the investigator? There is but one answer to this question. The only fully competent authority is a specialist versed in the department he undertakes to criticise. He only is adequately alive to what has previously been done, and can best estimate the difficulties that beset a complicated inquiry. He alone can pronounce most authoritatively on the validity of the methods employed, can appreciate the solutions arrived at, and can point out the collateral issues opened up. There should be specialists and specialists, and a specialist trained in one department is rarely fitted to pronounce upon the work of a specialist in another and totally distinct department.

The April number of the *Nineteenth Century* contains an article bearing the signature of Dr. W. B. Carpenter, and ostensibly treating of the "Radiometer and its Lessons." The description of the instrument itself and of its reception in scientific circles contains little perhaps openly or strikingly erroneous, but unfortunately Dr. Carpenter has endeavored to combine matters which have no possible connection with the radiometer; moreover, the omissions and inaccuracies which occur in his historical review of my experiments and published researches on the subject would seem to deprive his inferences and conclusions of any value which they otherwise might have possessed.

We are told [1] that when the theory of the radiometer was under discussion at the Royal Society Prof. Stokes confined himself to the statement that "such mechanical action must lie *outside* the undulatory theory, which deals only with light *as* light—i. e., as producing visual phenomena." The last four words are added by Dr. Carpenter to the observations of Prof. Stokes. That the undulatory theory gives no account of the phenomena of light, save so far as they are connected with the vision of man and animals, is, to say the least, a startling revelation.

Again, we read [2] that when the movement of the radiometer was discussed "it was noticed by several as anomalous, that the *black* should be the "driving" side of the disks, since it might have been anticipated that the mechanical action of light would manifest itself in pushing away the surface from which its rays are reflected, and that the surface into which they are absorbed would move toward the source from which the rays emanate." Dr. Carpenter here omits the explanation of this apparent anomaly given by me at the Royal Society, and accepted as satisfactory by the eminent physicists present, to the effect that the rays falling on the white surface are simply reflected off without doing any work; but the rays falling on the black surface

[1] P. 244. [2] Ibid.

are absorbed, and their energy, disappearing in its original form, reappears as mechanical motion.

Dr. Carpenter next affirms[1] that I committed myself "explicitly to the doctrine that the radiometer is driven by *light*." Later on I am accused of showing some lingering unwillingness to surrender this position; and I am then gravely censured for not knowing that *heat* causes the movement of the radiometer. Now, what are the facts? Let my own written words speak for me.

In 1873 I published[2] the description of an experiment proving that *every ray* of the spectrum produced repulsion: the maximum action being in the extreme red. In March, 1875, I wrote:[3]

"Although I most frequently speak of repulsion by *heat*, it must be clearly understood that these results are not confined to the heating rays of the spectrum, but that any ray, from the ultra-red to the ultra-violet, will produce repulsion in a vacuum."

So much for my earlier ideas on this subject. What are my later views regarding which, according to my critic, I still show "some lingering unwillingness to surrender my position?"

In 1876 I wrote:[4]

"Is the effect due to *heat* or *light?* I cannot answer this question. The terms heat and light are not definite enough. The physicist has no test for light independent of heat. Light and color are physiological accidents, due to the fact that a small portion near the middle of the spectrum happens to be capable of affecting the retina of the human eye. There is no real distinction between heat and light; all we can take account of is difference of wave-length."

After describing experiments with a pure solar spectrum, and giving numerical values for the motion-producing powers of the various colored rays, I continue:

"A comparison of these figures with those usually given in text-books to represent the distribution of heat in the spectrum will be a sufficient proof that the mechanical action of radiation is as much a function of the luminous rays as it is of the dark heat-rays."

Dr. Carpenter then accuses me of attributing the movement of the radiometer to *light*. The very contrary is the case. I have always sought to guard against this misconception, insisting that every ray of the spectrum, visible or invisible, must cause motion. Hence I call the instrument the radiometer—ray-measurer. Those who most persistently deny that light occasions the movements, curiously enough continue to use the term "*light*-mill."

Dr. Carpenter introduces an account of an experiment I showed at the Royal Institution, on the evening of the 11th of February, 1876, with the words—"This he called 'weighing a beam of light.'" Now, my actual words at the lecture were:[1]

"I want to ascertain the amount of pressure which radiation exerts on a blackened surface. I will put a ray of light on the pan of a balance, and give you its weight in grains. *For I think in this institution and before this audience I may be allowed a scientific use of the imagination, and may speak of weighing that which is not affected by gravitation.*"

The italicized words render it evident that I was only speaking figuratively; and not, as Dr. Carpenter wishes to make it appear, that I conceived light to be a material substance.

Another misstatement follows on the next page, where Dr. Carpenter pronounces it "as pure an assumption on Mr. Crookes's part to affirm that the *mechanical* action exerted by two flames of different kinds would measure their relative *illuminating* powers, as it would have been to say that their heating action would be proportional to their illuminating action, which we know perfectly well *not* to be the case—the gas-flame, as every one knows, having a much greater heating power than the candle-flame, in proportion to the light it gives."

Once again Dr. Carpenter omits part of my explanation. I will assume that he has read a portion of the description of the photometric experiment he criticises, given by me in the "Proceedings of the Royal Society," No. 167, 1876. Why did he not read the next sentence, beginning?—

"By interposing screens of water or plates of alum, and so practically cutting off all the dark heat, the actual luminosity is measured."

Or perhaps he gained his information from my Royal Institution lecture.[2] In this case he must have read the following remarks:

[1] P. 245.

[2] "Philosophical Transactions," vol. clxiv., p. 518.

[3] Ibid., vol. clxv., p. 526.

[4] Ibid., vol. clxvi., pp. 360–362.

[1] "Proceedings of the Royal Institution," February 11, 1876, and *Quarterly Journal of Science*, April, 1876, p. 250.

[2] *Loc. cit.*

"Before this instrument can be used as a photometer or light-measurer, means must be taken to cut off from it all those rays coming from the candle or gas which are not actually luminous. A reference to the spectrum diagram (Fig. 5) will show that at each end of the colored rays there is a large space inactive, as far as the eye is concerned, but active in respect to the production of motion—strongly so at the red end, less strong at the violet end. Before the instrument can be used to measure luminosity, these rays must be cut off. We buy gas for the light that it gives, not for the heat it evolves on burning, and it would therefore never do to measure the heat and pay for it as light."

Dr. Carpenter either failed to remember this explicit statement, or overlooked it.

In referring to the kinetic theory of gases as explaining the movement of the radiometer, Dr. Carpenter seems to imply that the question is altogether settled. He might, however, have found that this view is by no means universally accepted. That the movement of the radiometer is due not to any direct action of the solar (or other) rays, but to their effect upon residual gases, is now, indeed, owing to my more recent researches, a matter of demonstration. That some such explanation was in my mind at the time of my first publication of the phenomena, as one of the probable causes of the repulsion resulting from radiation, is shown hy the following quotations:

"I object to the term *perfect* as applied to any vacuum at present known.

"That the residual gas in an air-pump vacuum is capable of exerting considerable mechanical action may be assumed by the phenomena attending the passage of meteorites through the upper regions of the atmosphere, their friction against the air at an average height of sixty-five miles above the earth's surface raising them to incandescence.[1]

"Whether the ethereal waves actually strike the substance moved, or whether at that mysterious boundary-surface separating solid from gaseous matter, there are intermediary layers of condensed gas which, taking up the blow, pass it on to the layer beneath, are problems the solution of which must be left to further research."[2]

My experiment on the movement of the glass case of a radiometer[3] is termed "an ingenious arrangement first devised by Dr. Schuster and subsequently improved on by Mr. Crookes;" whereas, during the discussion which followed the reading of Dr. Schuster's paper at the Royal Society on the 23d of March, 1876, I mentioned an experiment which I had tried some time before, bearing on his observations. I afterward tried my own experiment in a modified form: and, as the results were very decided, and appeared calculated to throw light on many disputed points in the theory of these obscure actions, I described the experiment, and showed the apparatus at work, at the next meeting of the Royal Society. Without wishing in the least to detract from the merits of Dr. Schuster, I may add that our two experiments are entirely different as to mode of arrangement and simplicity of exhibition. They doubtless both prove the same thing—the existence of a reactionary force between the moving fly and the glass case; but, while Dr. Schuster's experiment requires special arrangement of lime-light, lantern, reflecting mirrors, torsion-threads, etc., and then temporarily demonstrates only the reactionary force, my experiment merely requires a radiometer floating in a basin of water, and a small magnet to fix the fly, when the case rotates steadily and continuously.

While Dr. Carpenter was trying to prove from my papers that I was committed to a wrong theory which I was reluctant to abandon, how could he avoid reading the following sentences?—

"Throughout the course of these investigations I have endeavored to remain unfettered by the hasty adoption of a theory which, in the early stages of an inquiry, must almost of necessity be erroneous. Some minds are so constituted that they seem impelled to form a theory on the slightest experimental basis. There is then great danger of their becoming advocates, and unconsciously favoring facts which seem to prove their preconceived ideas and neglecting others which might oppose their views. This is unfortunate, for the mind should always be free to exercise the judicial function, and give impartial weight to every phenomenon which is brought before it. *Any* theory will account for *some* facts; but only the true explanation will satisfy *all* the conditions of the problem, and this cannot be said of any theory which has yet come to my mind.[1]

"As there is much discussion at present respecting the cause of these movements, and as some misunderstanding seems to prevail as to my own views on the theory of the repulsion resulting from radiation, I wish to take this opportunity of removing the impression that I hold opinions which are in antagonism to some strongly-urged explanations of these actions. I have on five or six occasions specially stated that I wish to keep free from theories."[2]

[1] "Philosophical Transactions," December 11, 1873, vol. clxiv., pp 507, 524.

[2] *Philosophical Magazine*, August, 1874.

[3] "Proceedings of the Royal Society," No. 168, 1876.

[1] *Quarterly Journal of Science*, July, 1875.

[2] "Proceedings of the Royal Society," No. 168, 1876.

Why, also, may I ask, has Dr. Carpenter, when speaking of the radiometer, attributed to me the words "new force" and "new mode of force?" They are not my words. From which of my papers did he quote them?

The time for a mere popular preliminary sketch of the radiometer is gone by; that for its thorough and exhaustive appreciation has not yet come. Dr. Carpenter gives neither, but devotes the remaining part of his paper to exhibiting as a solitary "lesson" the contrast assumed to exist between Mr. Crookes, the physicist, investigating the phenomena of the radiometer, and Mr. Crookes the "spiritualist," examining the manifestations of "psychic force." To use his own language, he brings "into contrast with the admirable series of scientific investigations which led up to that invention, his" (Mr. Crookes's) "thoroughly unscientific course in relation to another doctrine of which he has put himself forward as the champion."

In order to prove what he terms the "duality" of my mental constitution, Dr. Carpenter contrasts my researches on the radiometer with some experiments I made six years ago, when I attempted to solve the mystery of the phenomena called spiritual, and he describes the apparatus I devised to test the alteration of the weight of suspended bodies in Mr. Home's presence, by mere contact, and without pressure. In a lecture delivered at Chelsea on the 19th of January, 1872, Dr. Carpenter referred to this experiment; and whether his description was accurate will be seen by an extract from a letter by Mr. A. R. Wallace, dated February 15, 1872:

"In the report of Dr. Carpenter's lecture at Chelsea there occurs a passage so extraordinary and so entirely misleading that I must beg you, in the interests of truth, to allow me to make a few remarks upon it. Dr. Carpenter is stated to have said that he would grapple with Mr. Crookes's 'Psychic Force;' and, in attempting to do so, exhibited an experiment tending to show (and which his audience must have believed really did show) that Mr. Crookes was ignorant of the merest rudiments of mechanics, and was deluded by an experiment, the fallacy of which an intelligent schoolboy could have pointed out. Dr. Carpenter, it is said, exhibited a glass of water poised against an equal weight upon a balance, and showed that by dipping a finger in the water—that is, by *pressing* with a force exactly equal to the weight of the water displaced by the immersed finger—you increased the weight on that side of the balance. Now, unless the audience were intended to believe that Mr. Crookes was ignorant of this childishly simple fact, and, further, that it completely accounted for the result of his experiment, for what purpose was this experiment shown? Yet if this *is* what it was intended to prove, then it becomes absolutely certain that Dr. Carpenter could never have read Mr. Crookes's account of his experiments given in October last in the *Quarterly Journal of Science* (for he would certainly not wilfully misrepresent the experiment), and was, therefore in complete ignorance of what he was attempting to disprove. For, will it be believed, Mr. Crookes expressly states that, '*dipping the hand to the fullest extent into the water does not produce the least appreciable action on the balance*,' the reason of which is sufficiently clear, for his woodcut shows, and his description tells us, that the vessel of water was not placed on the scale of a balance at all, but on a board *exactly over its fulcrum* or point of support at one end, while the distant end was suspended from a balance. Yet this balance showed a force of more than *one pound* exerted on it when Mr. Home merely dipped the tips of the fingers of one hand in the water!"

I have no wish in this article to discuss Mr. Home's psychic powers. I simply wish to ask, has Dr. Carpenter described my test arrangements correctly, and were these arrangements scientifically devised and employed, or were they, as Dr. Carpenter maintains, absurd, and even childish? Dr. Carpenter says, in the *Nineteenth Century:*

"Nothing would have been easier than for Mr. Crookes, on the one hand, to carefully watch Mr. Home, to precisely imitate his whole procedure, and to do his best to depress the board to the same degree by his own muscular effort; and, on the other hand, to devise an 'indicator' for *downward* pressure, by which it could be at once determined whether Mr. Home could depress the lever-board without such muscular effort. . . . The *fact* was simply that the lever-board went down when Mr. Home's hands were laid upon it; and the testimony of Mr. Crookes and his friends was quite sufficient to justify others in accepting it as such. On the other hand, Mr. Crookes's assertion that the lever-board went down in obedience to some other force than that of Mr. Home's muscular pressure was *not* a fact, but an inference drawn by Mr. Crookes; and this inference he had no scientific right to draw until he had assured himself by every conceivable test that Mr. Home *did* not and *could* not so depress it."

Dr. Carpenter also says that I have never published any proof obtained from these test-experiments, although explicitly challenged to do so in the *Quarterly Review*, October, 1871.

Dr. Carpenter must surely know that the experiment to which he takes exception was merely the first of a series. Had he described the later

experiments in full, the public could not have failed to perceive that the test which I am blamed for not trying would have been utterly useless. I will, therefore, briefly describe these experiments, which are given in detail, and illustrated with woodcuts, in the *Quarterly Journal of Science* for July and October, 1871. To meet the *foreseen* objection, that while the attention of the observers was otherwise engaged, Mr. Home might possibly slide his fingers along the board, and thus obtain leverage, I placed a vessel of water *with its centre exactly over the fulcrum* of the board the extremity of which was attached to the weighing-machine. To prevent Mr. Home touching the bottom of the vessel, and to lessen the possibility of "rhythmical agitation," a copper basin, with several perforations in its bottom, was supported on a retort-stand, so as to dip into the water in the first vessel. Into this basin Mr. Home plunged his fingers. By this arrangement it was rendered impossible for Mr. Home to obtain leverage—that is, if the doctrine still holds good that water transmits pressure equally in all directions. Further, the copper vessel acting as a breakwater, any rhythmical agitation set up by Mr. Home would be much enfeebled before reaching the bottom of the outer vessel. Yet, in spite of these precautions, the depressions of the board were substantially the same as when Mr. Home placed his fingers on the wood. But I went still further. I caused Mr. Home to place his hands not on the board at all, but on the table on which the fulcrum rested, first near the end of the board, and then at distances gradually increasing to three feet. Still, the balance recorded great variations of pressure. Finally, while Mr. Home placed his hands in the position just mentioned, witnesses held both his hands and his feet. The result was still the same, the balance indicating ebbs and flows of pressure. I submit, therefore, that Dr. Carpenter's test would have been here a mere waste of time, and that I was fully justified in its omission. Indeed, it was as unnecessary as a determination of Mr. Home's "downward pressure" on the chair on which he was sitting, or on his boots when standing.

One most significant conclusion which might be drawn, and which must surely suggest itself to every man of science who reads the history of the radiometer, is the importance of *residual phenomena*. It is well known to chemists that of late years new elementary bodies, new interesting compounds, have often been discovered in residual products, in slags, flue-dusts, and waste of various kinds. In like manner, if we carefully scrutinize the processes either of the laboratory or of Nature, we may occasionally detect some slight anomaly, some excess or deficiency of action, some unanticipated phenomenon, which we cannot account for, and which, were received theories correct and sufficient, ought not to occur. Such residual phenomena are hints which may lead the man of disciplined mind and of finished manipulative skill to the discovery of new elements, of new laws, possibly even of new forces. Upon undrilled men these possibilities are simply thrown away. The untrained physicist or chemist fails to catch these suggestive glimpses. If they appear under his hands, he ignores them as the miners of old did the ores of cobalt and nickel. That in the experiments undertaken to determine the atomic weight of thallium I should at once detect a slight anomaly in the action of my very delicate balance, should consider it worthy of the most minute and protracted investigation, and should follow up the clew for so many years, is surely sufficient to refute the charge of imperfect training advanced by Dr. Carpenter at the close of his article in the *Nineteenth Century*. The moral might have been pointed with additional force by a reference to my discovery of thallium itself, which was likewise the result of the careful and systematic examination of a chemical residue, in which, when a mere boy, I had detected a chemical anomaly, and noted it for further investigation.

This great lesson—the importance of residual phenomena—must be pronounced of the highest moment to the student, and interesting, surely, even to the multitude. Yet, Dr. Carpenter, addressing a highly-cultivated class of readers, overlooks it altogether! He gives, indeed, an account of the "origin of these researches," and pronounces it "rather singular," but the moral he desires to point is of a totally different nature.

As I have said, Dr. Carpenter can draw but one lesson from the analysis of my scientific researches, and he insists that it is criminal to be "'possessed' of any ideas, or class of ideas, that the common-sense of educated mankind pronounces to be irrational." [1] But the "common-sense of educated mankind" at one time denied the circulation of the blood, and pronounced the earth to be the immovable centre of the universe. At the present day it upholds errors and absurdities innumerable, and "common-sense" has been well characterized as the name under which men deify their own ignorance. Are scientific men never to

[1] Page 256.

step over a rigid line, to refrain from investigation because it would clash with common-sense ideas? How far should we have advanced in knowledge if scientific men had never made known new discoveries, never published the results of their researches for fear of outraging this "common-sense of educated mankind?" Take the very subject which suggests the text for Dr. Carpenter's article. Can the wildest dreams of the spiritualist ask credence to anything more repugnant to "common-sense" than the hypothesis imagined by Science and now held to account for the movements of the radiometer? In the glass bulb which has been exhausted to such a degree that "common-sense" would pronounce it to be quite empty, we must conceive there are innumerable smooth elastic spheres, the molecules of the residual gas, dashing about in apparent confusion, with sixty times the velocity of an express-train, and hitting each other millions of times in a second. Will the "common-sense of educated mankind" consider this rational doctrine? Again, both inside this empty space and outside it, between the reader and the paper before him, between the earth and the sun, occupying all the interplanetary space farther than the eye can reach or indeed the mind can conceive, there is assumed to be a *something* indefinitely more elastic and immeasurably more solid than tempered steel, a medium in which suns and worlds move without resistance. Is not such a doctrine utterly incredible to the "common-sense of educated mankind?" Yet the kinetic theory of gases and the undulatory theory of light are accepted as true by nine-tenths of the scientific men of the present day; and doubtless in the processes of scientific evolution in the coming times many a discovery will be brought to light to give a sharp shock to the "common-sense of educated mankind."—*Nineteenth Century.*

CAP—A NEW ENGLAND DOG.

By THOMAS K. WILLIAMS.

CAP was the usual name of Captain; its owner being a large Newfoundland dog just crossed with the stag-hound, making him the handsomest animal I ever saw, standing very tall, with elegantly-curved neck and long, silky ears that one could pull down and meet under his chin. His whole head was a wonder of dog-beauty, with long nose and wondrously expressive eyes, which laughed or cried with you, always sympathizing whatever your mood might be; ready for a romp, or to come and press his nose through your arm, looking up with almost crying eyes, seeming to wish to show his sorrow at your grief. He had great tact, greater than many human friends, never obtruding his sympathy; but lying quietly down, his nose between his paws, he would watch every changing expression of face, till the time came when he thought he could offer tangible sympathy; then he would get up and come to you, seeming to wish, by showing his own excessive love, to make amends for any shortcomings on the part of the world. And in return, having given his all, he wished the same, and could not put up with any division of affection with any other animal, scarcely with a human being; and his intelligence aided his jealousy in gaining the point. He always accompanied my father to the office, which was at the head of a *very long* flight of stairs, and there spent most of the day, amusing himself indifferently with looking out of the window and with the people coming to and from the office. One warm day, the door being open, and being much bored and put to it as to how to spend his time, he spied a black-and-tan dog which belonged across the street: acting on the impulse, he went down and invited him up; which arrangement was very pleasing and satisfactory till, in the course of their play, Mr. Black-and-Tan jumped into a chair beside my father, who, attracted by the little thing, put out his hand and caressed him. Captain was very angry, and almost flew at the dog, then thought better of it, and bided his time. When Black-and-Tan got down, Cap was unusually amiable and frisky, playing with him round and round, always a little nearer and nearer the door, till, at the head of the stairs, he gave one great shove, and sent him flying to the bottom. And never was that little dog allowed over those stairs again. When he saw him coming, or when he himself wished for a play, he would go down and play in the hall below, or in the street, thus keeping full possession of his own domain.

He had a remarkable memory, recognizing

friends by face or voice, though perhaps for a year or two absent, and would run, wagging body and tail equally, to meet them. But this was not so astonishing as his memory for things. Like all Newfoundlands he was passionately fond of bathing, and had a certain stick which he always carried to the water, and on returning put in a particular place in our back-yard; for, mind you, he had a bump for order. He put it away for the last time in October, the water being too cold to bathe later: snow came soon after, covering it up for months; and it was late in May before it was warm enough to swim again. My father said, "Cap! would you like to go to the water?" He jumped up, said "Yes" in his way, ran to the door, round the house, over the fence, had the stick and back again, panting with excitement. Some one coming just then, my father had to say, "Not to-day, Cap, to-morrow:" slowly and lingeringly he walked back and deposited the stick. The next morning, however, on coming down, Cap was at the door, stick in mouth, apparently having perfectly understood the cause of delay, and determined to be in season to have no interruptions this time. Of course he was taken to the water immediately and had a grand bath: singularly this was the only occasion he was ever known to take his stick from its place without a particular invitation. Certainly he understood.

And he read character to a marvel, measuring each member of the household, understanding what he could, and what he could not, do with each. With those who could master him, he never held out uselessly, but yielded with a peculiar grace, quite his own; with those who could not, why he mastered them! Not overbearingly, but impudently; and when requested by them to do anything disagreeable to him, would wag his tail as much as to say, "I'm not in a mind to, and I know you won't make me."

They even laughed, and said he understood the politics of the family, and from his amusing aversion to negroes one would suppose so, as he could never abide the sight of that African race. One night a colored man being sent to the house with some ice-cream, shrieks and a general sound of rumpus brought us all to the kitchen, where Cap had half torn the clothes off the man, who, with rolling whites, now stood petrified and livid with fright; Cap making fresh plunges, carrying off pieces of clothing each time. Indeed, it was almost impossible to take the dog off, so inveterate was his hatred. The servants, on being questioned, said the man had done nothing. But never did he see one of this race, even in the street, without hot pursuit.

This was in the war-time, when Fort Warren was hung over our heads—so much for his pluck and party principles!

Beggars he looked on with a suspicious eye, and always watched closely, but never molested.

Little dogs were treated by him with contempt—not noticing their presence, or even insults, at first; but if too persistent and intolerable, he would give them a sound shaking, and throwing them over, would look off into space—quite unconscious—an expression inimitable, I assure you. In general he did not affect dog-company; carrying himself with a grand air and great dignity, he would look at them and pass on. Perhaps a sense of superior intelligence caused this *hauteur*, more probably family pride; for mark you, Cap was nephew to the Prince of Wales's dog, the prince, while in this country, having had the finest specimen of a Newfoundland in the provinces presented to him. Whatever evolutions of thought Cap may have had, the fact is the same.

When a child, I had a severe typhoid fever, and every morning Cap was sent with a note tied to his collar with tidings of my welfare to my grandmother. Nothing could distract him on such an errand; but, when arrived at the house, he would go straight and lay his head in her lap till the note was untied. Then, considering his duty done, he would go to the kitchen, be fed, and inspect the dinner—to which he always returned, if to his mind; but if it was to be of poultry, or game of any kind, they saw him no more that day.

My father bought Cap when a pup for us children to play with, and great fun we had. As we grew older he came into the house with us, our constant companion, my own especial friend and confidant. I told him everything, and he never peached. Thus constantly with us, and talked to, he learned to understand all that was said, whether directly addressed to him or not; and the following story is strictly true, incredible as it may seem.

My father and mother were reading, and one of them, noticing an article about water standing in a room overnight absorbing impure gases, and being unhealthy to drink, read it aloud, and remarked, "If that's the case, we must be sure and see that Cap's water is changed every morning." He had water always in mother's dressing-room, where he went and drank when he liked. Cap lay on the floor, apparently unobservant. The

next day he went to a member of the family and asked for water; he had a peculiar way of asking for different things, so that those who knew him could tell his wants. She went to the dressing-room, and there was plenty of water. Cap looked at it, languidly tasted, and then looked up, thinking something must be the matter; it was turned away, and fresh water given him, which he drank. The next day the same thing occurred, and the next after, so as to be remarked, and an explanation asked, when the foregoing conversation was recalled; and never till the day of his death, three years later, did he touch a drop of water without having first seen it poured freshly out, though never before had he thought of objecting.

Captain slept in the house at night, on the broad, flat landing where the stairs turned, thus having full view and command of everything; the doors were all left open, and every morning at about five he would go and put his nose in my father's hand and wake him up, apparently to tell him the night was safely past; being patted, and "All right, Cap," said, he would go down, having completed his vigil, to await the first appearance of a servant, to let him out for his morning walk, which was usually short. Just before going to bed he also took a walk, which was not so sure to be short if the night was pleasant—unless requested to return soon; he would then come back almost immediately. Whenever my father went away, he would lie at the foot of my mother's bed, realizing that there was a change, and that she needed protection.

He was essentially companionable, and could not tolerate being left alone—not that I think he had sins to think of that made him unhappy, but he loved company, and would follow me miles on a walk; and it was on one of these walks, when I was older, and, alas! he too, that his first signs of advancing age showed themselves. The day was very warm, and Cap accompanied me to take a lesson some distance out of town. During the lesson he asked for water, which when brought he could scarcely reach, his hind-legs being almost powerless. His endeavors to walk were most agonizing; he looking to me uncomprehending the cause, and asking for help. After a while he was better, and I started to walk home with him, there being no carriage or other conveyance obtainable in the place. We had gone but a short distance when Cap again wanted water, and I stopped at the country grocery-store to get some They brought it from the back of the store, but he could not drink, and lay down quite overcome. My own misery was intense, for I thought him dying. There was the usual gathering of a corner store, who all tried to console me with accounts of their dogs. One voluble Yankee told of his: "The little black one with white spots, you knowed him, you know!" I suppose I looked a little blank, for he said, "Anyhow, Jim did!" turning to the store-keeper for corroboration. "Wall, he got a-foul a toad one day, and was just so. He'll come out on it all right." Every one stopped who passed, till quite a crowd collected, each one with his own theory. In time a teamster with his dray loaded with lumber was passing, whom I hailed, told the necessities of the case, and he consented to unload his timber by the side of the road and take Cap home. The timber being taken off and Captain put in its place, the teamster started. Cap began to try to wriggle himself off the dray, not liking the distance between him and me on the sidewalk. He would have infallibly fallen off between the wheels, so the man stopped—it was no go. I then got on and he made no further objection, so we journeyed into town, I holding an umbrella over his head, little thinking of the figure I cut!

When arrived at home, the veterinary surgeon was called, but not being able to attend immediately, father, thinking Cap poisoned, applied all sorts of known antidotes. Among others, oil was poured down his throat, and in the resistance he bit my father—not viciously, but naturally, for who does not remember the days when some one held our noses, and another some one poured the detested castor-oil down, and what vigorous remonstrances we made? When the surgeon came he pronounced it a slight attack of paralysis, and we knew we should not have Cap much longer. He recovered, though, and went about for a time as usual.

The garden was a delight to him, filled with fruit and flowers. One would think he really had a sense of the beautiful to see him stop at a rose-bush and contemplate it. Indeed, he did his best to keep things in order by not running across-lots, but always in the paths with the utmost propriety. Fruit of all kinds he liked, especially gooseberries, which he picked for himself with great care, holding up his lips and turning his head under the branch, then carefully pulling them off one by one. But if any one was in the garden, not he! That must be done for him. He would follow me from bush to bush,

and, if by chance I was more greedy than he thought proper, would get up, nudge me, and lie down again, reminding me of his presence, and that he must have his share.

In January of 1872 one evening Cap had gone for his walk; my sister passing through the hall heard a faint rap, and, going to the door, Cap came in and up-stairs. Noticing something strange in his walk, she called father, who came out of the library and spoke. Cap hearing his voice, ran to the stairs, and on attempting to descend fell headlong, and only stopped at the landing. We all knew what was the matter. Going up-stairs my father put his arms under him, I behind, and we brought him down. There he lay, and could not bear to have us leave him, growing worse all the time, but responding to our caresses by a wag of the tail—less and less—till the very last, when only an inch moved, the rest of the body being quite stiff and rigid, and as the day left us, so did Captain.—*Macmillan's Magazine.*

THE SOUL AND FUTURE LIFE.

By FREDERIC HARRISON.

II.

THE rational view of the soul (we insisted in a previous paper) would remove us as far from a cynical materialism as from a fantastic spiritualism. It restores to their true supremacy in human life those religious emotions which materialism forgets; while it frees us from the idle figment which spiritualism would foist upon human nature.

We entirely agree with the theologians that our age is beset with a grievous danger of materialism. There is a school of teachers abroad, and they have found an echo here, who dream that victorious vivisection will ultimately win them anatomical solutions of man's moral and spiritual mysteries. Such unholy nightmares, it is true, are not likely to beguile many minds in a country like this, where social and moral problems are still in their natural ascendant. But there is a subtiler kind of materialism, of which the dangers are real. It does not, indeed, put forth the bestial sophism that the apex of philosophy is to be won by improved microscopes and new batteries. But, then, it has nothing to say about the spiritual life of man; it has no particular religion; it ignores the soul. It fills the air with pæans to science; it is never weary of vaunting the scientific methods, the scientific triumphs. But it always means physical, not moral science; intellectual, not religious conquests. It shirks the question of questions—to what human end is this knowledge?—how shall man thereby order his life as a whole?—where is he to find the object of his yearnings of spirit? Of the spiritual history of mankind it knows as little, and thinks as little, as of any other sort of Asiatic devil-worship. At the spiritual aspirations of the men and women around us, ill at ease for want of some answer, it stares blankly, as it does at some spirit-rapping epidemic. "What is that to us?—see thou to that"—is all that it can answer when men ask it for a religion. It is of the religion of all sensible men, the religion which all sensible men never tell. With a smile or a shrug of the shoulders it passes by into the whirring workshops of science (that is, the physical prelude of science); and it leaves the spiritual life of the soul to the spiritualists, theological or nonsensical as the case may be, wishing them both in heaven. This is the materialism to fear.

The theologians and the vast sober mass of serious men and women who want simply to live rightly are quite right when they shun and fear a school that is so eager about cosmology and biology, while it leaves morality and religion to take care of themselves. And yet they know all the while that before the advancing line of positive thought they are fighting a forlorn hope; and they see their own line daily more and more demoralized by the consciousness that they have no rational plan of campaign. They know that their own account of the soul, of the spiritual life, of Providence, of heaven, is daily shifting—is growing more vague, more inconsistent, more various. They hurry wildly from one untenable position to another, like a routed and disorganized army. In a religious discussion years ago we once asked one of the Broad Church, a disciple of one of its eminent founders, what he understood by the Third Person of the Trinity; and he said, doubt-

fully, that "he fancied there was a sort of a something." Since those days the process of disintegration and vaporization of belief has gone on rapidly; and now very religious minds, and men who think themselves to be religious, are ready to apply this "sort of a something" to all the verities in turn. They half hope that there is "a sort of a something" fluttering about, or inside, their human frames, that there may turn out to be a "something" somewhere after death, and that there must be a sort of a somebody or (as the theology of culture will have it) a sort of a something controlling and comprehending human life. But the more thoughtful spirits, not being professionally engaged in a doctrine, mostly limit themselves to a pious hope that there may be something in it, and that we shall know some day what it is.

Now, theologians and religious people unattached must know that this will never serve—that this is paltering with the greatest of all things. What, then, is the only solution which can ultimately satisfy both the devotees of science and the believers in religion? Surely but this, to make religion scientific by placing religion under the methods of science. Let science come to see that religion, morality, life, are within its field, or, rather, are the main part of its field. Let religion come to see that it can be nothing but a prolongation of science, a rational and homogeneous result of cosmology and biology, not a matter of fantastic guessing. Then there will be no true science which does not aim at, and is not guided by, systematic religion. And there will be no religion which pretends to any other basis but positive knowledge and scientific logic. But for this science must consent to add spiritual phenomena to its curriculum, and religion must consent to give up its vapid figments.

Positivism in dealing with the soul discards the exploded errors of the materialists and spiritualists alike. On the one hand, it not only admits into its studies the spiritual life of men, but it raises this life to be the essential business of all human knowledge. All the spiritual sentiments of man, the aspirations of the conscious soul in all their purity and pathos, the vast religious experience and potentialities of the human heart seen in the history of our spiritual life as a race—this is, we say, the principal subject of science and of philosophy. No philosophy, no morality, no polity, can rest on stable foundations if this be not its grand aim; if it have not a systematic creed, a rational object of worship, and a definite discipline of life. But, then, we treat these spiritual functions of the soul, not as mystical enigmas, but as positive phenomena, and we satisfy them by philosophic and historic answers and not by naked figments. And we think that the teaching of history and a true synthesis of science bring us far closer to the heart of this spiritual life than do any spiritualist guesses, and do better equip us to read aright the higher secrets of the soul: meaning always by soul the consensus of the faculties which observation discovers in the human organism.

On the other hand, without entering into an idle dispute with the spiritualist orthodoxy, we insist on regarding this organism as a perfectly homogeneous unit, to be studied from one end of it to the other by rational scientific methods. We pretend to give no sort of *cause* as lying behind the manifold powers of the organism. We say the immaterial entity is something which we cannot grasp, which explains nothing, for which we cannot have a shadow of evidence. We are determined to treat man as a human organism, just as we treat a dog as a canine organism; and we know no ground for saying, and no good to be got by pretending, that man is a human organism *plus* an indescribable entity. We say the human organism is a marvelous thing, sublime if you will, of subtilest faculty and sensibility; but we, at any rate, can find nothing in man which is not an organic part of this organism; we find the faculties of mind, feeling, and will, directly dependent on physical organs; and to talk to us of mind, feeling, and will, continuing their functions in the absence of physical organs and visible organisms, is to use language which, to us at least, is pure nonsense.

And now to turn to the great phenomenon of material organisms which we call Death. The human organism, like every other organism, ultimately loses that unstable equilibrium of its correlated forces which we name Life, and ceases to be an organism or system of organs, adjusting its internal relations to its external conditions. Thereupon the existence of the complex independent entity to which we attribute consciousness undoubtedly—i. e., for aught we know to the contrary—comes to an end. But the activities of this organism do not come to an end, except so far as these activities need fresh sensations and material organs. And a great part of these activities, and far the noblest part, only need fresh sensations and material organs in other similar organisms. While there is an abundance of these in due relation, the activities go on *ad infinitum*, with increasing energy. We

have not the slightest reason to suppose that the consciousness of the organism continues, for we mean by consciousness the sum of sensations of a particular organism, and the particular organism being dissolved, we have nothing left whereto to attribute consciousness, and the proposal strikes us like a proposal to regard infinity as conscious. So, of course, with the sensations separately, and with them the power of accumulating knowledge, of feeling, thinking, or of modifying the existence in correspondence with the outward environment. Life, in the technical sense of the word, is at an end, but the activities of which that life is the source were never so potent. Our age is familiar enough with the truth of the persistence of energy, and no one supposes that with the dissolution of the body the forces of its material elements are lost. They only pass into new combinations and continue to work elsewhere. Far less is the energy of the activities lost. The earth, and every country, every farmstead, and every city on it, are standing witnesses that the physical activities are not lost. As century rolls after century, we see in every age more potent fruits of the labor which raised the pyramids, or won Holland from the sea, or carved the Theseus out of marble. The bodily organisms which wrought them have passed into gases and earths, but the activity they displayed is producing the precise results designed on a far grander scale in each generation. Much more do the intellectual and moral energies work unceasingly. Not a single manifestation of thought or feeling is without some result so soon as it is communicated to a similar organism. It passes into the sum of his mental and moral being.

But there is about the persistence of the moral energies this special phenomenon. It marks the vast interval between physical and moral science. The energies of material elements, so far as we see, disperse, or for the most part disperse. The energies of an intellectual and moral kind are very largely continued in their organic unities. The consensus of the mental, of the moral, of the emotional powers may go on, working as a whole, producing precisely the same results, with the same individuality, whether the material organism, the source and original base of these powers, be in physical function or not. The mental and moral powers do not, it is true, increase and grow, develop or vary, within themselves. Nor do they in their special individuality produce visible results, for they are no longer in direct relations with their special material organisms. But the mental and moral powers are not dispersed like gases. They retain their unity, they retain their organic character, and they retain the whole of their power of passing into and stimulating the brains of living men; and in these they carry on their activity precisely as they did, while the bodies in which they were formed absorbed and exhaled material substance.

Nay, more: the individuality and true activity of these mental and moral forces is often not manifest, and sometimes is not complete, so long as the organism continues its physical functions. Newton, we may suppose, has accomplished his great researches. They are destined to transform half the philosophy of mankind. But he is old, and incapable of fresh achievements. We will say he is feeble, secluded, silent, and lives shut up in his rooms. The activity of his mighty intellectual nature is being borne over the world on the wings of Thought, and works a revolution at every stroke. But otherwise the man Newton is not essentially distinguishable from the nearest infirm pauper, and has as few and as feeble relations with mankind. At last the man Newton dies—that is, the body is dispersed into gas and dust. But the world, which is affected enormously by his intellect, is not in the smallest degree affected by his death. His activity continues the same; if it were worth while to conceal the fact of his death, no one of the millions who are so greatly affected by his thoughts would perceive it or know it. If he had discovered some means of prolonging a torpid existence till this hour, he might be living now, and it would not signify to us in the slightest degree whether his body breathed in the walls of his lodging or mouldered in the vaults of the Abbey.

It may be said that, if it does not signify much to us, it signifies a great deal to Isaac Newton. But is this true? He no longer eats and sleeps, a burden to himself; he no longer is destroying his great name by feeble theology or querulous pettiness. But if the small weaknesses and wants of the flesh are ended for him, all that makes Newton (and he had always lived for his posthumous, not his immediate fame) rises into greater activity and purer uses. We make no mystical or fanciful divinity of Death; we do not deny its terrors or its evils. We are not responsible for it, and should welcome any reasonable prospect of eliminating or postponing this fatality, that waits upon all organic Nature. But it is no answer to philosophy or science to retort that Death is so terrible, therefore man must be designed to escape it. There are savages who persistently deny that men do die at all, either

their bodies or their souls, asserting that the visible consequences of death are either an illusion or an artfully-contrived piece of acting on the part of their friends, who have really decamped to the happy hunting-fields. This seems on the whole a more rational theory than that of immaterial souls flying about space, as the spontaneous fancies of savages are sometimes more rational than the elaborate hypotheses of metaphysics.

But though we do not presume to apologize for death, it is easy to see that many of the greatest moral and intellectual results of life are only possible, can only begin, when the claims of the animal life are satisfied; when the stormy, complex, and checkered career is over, and the higher tops of the intellectual or moral nature alone stand forth in the distance of time. What was the blind old harper of Scio to his contemporaries, or the querulous refugee from Florence, or even the boon-companion and retired playwright of Stratford, or the blind and stern old malignant of Bunhill Fields? The true work of Socrates and his life only began with his resplendent death, to say nothing of yet greater religious teachers, whose names I refrain from citing; and as to those whose lives have been cast in conflicts —the Cæsars, the Alfreds, the Hildebrands, the Cromwells, the Fredericks—it is only after death, oftenest in ages after death, that they cease to be combatants, and become creators. It is not merely that they are only recognized in after-ages; the truth is, that their activity only begins when the surging of passion and sense ends, and turmoil dies away. Great intellects and great characters are necessarily in advance of their age; the care of the father and the mother begins to tell most truly in the ripe manhood of their children, when the parents are often in the grave, and not in the infancy which they see and are confronted with. The great must always feel with Kepler, "It is enough, as yet, if I have a hearer now and then in a century." John Brown's body lies a-mouldering in the grave, but his soul is marching along.

We can trace this truth best in the case of great men; but it is not confined to the great. Not a single act of thought or character ends with itself. Nay, more; not a single nature in its entirety but leaves its influence for good or for evil. As a fact the good prevail; but all act, all continue to act indefinitely, often in ever-widening circles. Physicists amuse us by tracing for us the infinite fortunes of some wave set in motion by force, its circles and its repercussions perpetually transmitted in new complications. But the career of a single intellect and character is a far more real force when it meets with suitable intellects and characters into whose action it is incorporated. Every life more or less forms another life, and lives in another life. Civilization, nation, city, imply this fact. There is neither mysticism nor hyperbole, but simple observation in the belief, that the career of every human being in society does not end with the death of its body. In some sort its higher activities and potency can only begin truly when change is no longer possible for it. The worthy gain in influence and in range at each generation, just as the founders of some populous race gain a greater fatherhood at each succeeding growth of their descendants. And, in some infinitesimal degree, the humblest life that ever turned a sod sends a wave—no, more than a wave, a life—through the ever-growing harmony of human society. Not a soldier died at Marathon or Salamis, but did a stroke by which our thought is enlarged and our standard of duty formed to this day.

Be it remembered that this is not hypothesis, but something perfectly real—we may fairly say undeniable. We are not inventing an imaginary world, and saying it must be real because it is so pleasant to think of; we are only repeating truths on which our notion of history and society is based. The idea, no doubt, is usually limited to the famous, and to the great revolutions in civilization. But no one who thinks it out carefully can deny that it is true of every human being in society in some lesser degree. The idea has not been, or is no longer, systematically enforced, invested with poetry and dignity, and deepened by the solemnity of religion. But why is that? Because theological hypotheses of a new and heterogeneous existence have deadened our interest in the realities, the grandeur, and the perpetuity of our earthly life. In the best days of Rome, even without a theory of history or a science of society, it was a living faith, the true religion of that majestic race. It is the real sentiment of all societies where the theological hypothesis has disappeared. It is no doubt now in England the great motive of virtue and energy. There have been few seasons in the world's history when the sense of moral responsibility and moral survival after death was more exalted and more vigorous than with the companions of Vergniaud and Danton, to whom the dreams of theology were hardly intelligible. As we read the calm and humane words of Condorcet on the very edge of his yawning grave, we learn how the conviction of post-

humous activity (not of posthumous fame), how the consciousness of a coming incorporation with the glorious future of his race, can give a patience and a happiness equal to that of any martyr of theology.

It would be an endless inquiry to trace the means whereby this sense of posthumous participation in the life of our fellows can be extended to the mass, as it certainly affects already the thoughtful and the refined. Without an education, a new social opinion, without a religion—I mean an organized religion, not a vague metaphysic—it is doubtless impossible that it should become universal and capable of overcoming selfishness. But make it at once the basis of philosophy, the standard of right and wrong, and the centre of a religion, and this will prove, perhaps, an easier task than that of teaching Greeks and Romans, Syrians and Moors, to look forward to a future life of ceaseless psalmody in an immaterial heaven. The astonishing feat was performed; and, perhaps, it may be easier to fashion a new public opinion, requiring merely that an accepted truth of philosophy should be popularized, which is already the deepest hope of some thoughtful spirits, and which does not take the suicidal course of trying to cast out the devil of selfishness by a direct appeal to the personal self.

It is here that the strength of the human future over the celestial future is so clearly pre-eminent. Make the future hope a social activity, and we give to the present life a social ideal. Make the future hope personal beatitude, and personality is stamped deeper on every act of our daily life. Now we make the future hope, in the truest sense, social, inasmuch as our future is simply an active existence prolonged by society. And our future hope rests not in any vague yearning, of which we have as little evidence as we have definite conception: it rests on a perfectly certain truth, accepted by all thoughtful minds, the truth that the actions, feelings, thoughts, of every one of us—our minds, our characters, our *souls*, as organic wholes—do marvelously influence and mould each other; that the highest part of ourselves, the abiding part of us, passes into other lives and continues to live in other lives. Can we conceive a more potent stimulus to rectitude, to daily and hourly striving after a true life, than this ever-present sense that we are indeed immortal; not that we have an immortal something within us, but that in very truth we ourselves, our thinking, feeling, acting personalities, are immortal; nay, cannot die, but must ever continue what we make them, working and doing, if no longer receiving and enjoying? And not merely we ourselves, in our personal identity, are immortal, but each act, thought, and feeling, is immortal; and this immortality is not some ecstatic and indescribable condition in space, but activity on earth in the real and known work of life, in the welfare of those whom we have loved, and in the happiness of those who come after us.

And can it be difficult to idealize and give currency to a faith which is a certain and undisputed fact of common-sense as well as of philosophy? As we *live for others* in life, so we *live in others* after death, as others have lived in us, and all for the common race. How deeply does such a belief as this bring home to each moment of life the mysterious perpetuity of ourselves! For good, for evil, we cannot die; we cannot shake ourselves free from this eternity of our faculties. There is here no promise, it is true, of eternal sensations, enjoyments, meditations. There is no promise, be it plainly said, of anything but an immortality of influence, of spiritual work, of glorified activity. We cannot even say that we shall continue to love; but we know that we shall be loved. It may well be that we shall consciously know no hope ourselves; but we shall inspire hopes. It may be that we shall not think; but others will think our thoughts, and enshrine our minds. If no sympathies shall thrill along our nerves, we shall be the spring of sympathy in distant generations; and that, though we be the humblest and the least of all the soldiers in the human host, the least celebrated and the worst remembered. For our lives live when we are most forgotten; and not a cup of water that we may have given to an unknown sufferer, or a wise word spoken in season to a child, but has added (whether we remember it, whether others remember it or not) a streak of happiness and strength to the world. Our earthly frames, like the grain of wheat, may be laid in the earth—and this image of our great spiritual Master is more fit for the social than for the celestial future—but the grain shall bear spiritual fruit, and multiply in kindred natures and in other selves.

It is a merely verbal question if this be the life of the Soul when the Soul means the sum of the activities, or if there be any immortality where there is no consciousness. It is enough for us that we can trust to a real prolongation of our highest activity in the sensible lives of others, even though our own forces can gain nothing new, and are not reflected in a sensitive body. We do not get rid of Death, but we transfigure Death. Does any religion profess to do

more? It is enough for any creed that it can teach *non omnis moriar;* it would be gross extravagance to say *omnis non moriar*, no part of me shall die. Death is the one inevitable law of Life. The business of religion is to show us what are its compensations. The spiritualist orthodoxy, like every other creed, is willing to allow that death robs us of a great deal, that very much of us does die; nay, it teaches that this dies utterly, forever, leaving no trace but dust. And thus the spiritualist orthodoxy exaggerates death, and adds a fresh terror to its power. We, on the contrary, would seek to show that much of us, and that the best of us, does not die, or at least does not end. And the difference between our faith and that of the orthodox is this: we look to the permanence of the activities which give others happiness; they look to the permanence of the consciousness which can enjoy happiness. Which is the nobler?

What need we then to promise or to hope more than an eternity of spiritual influence? Yet, after all, 'tis no question as to what kind of eternity man would prefer to select. We have no evidence that he has any choice before him. If we were creating a universe of our own and a human race on an ideal mould, it might be rational to discuss what kind of eternity was the most desirable, and it might then become a question if we should not begin by eliminating death. But as we are, with death in the world, and man as we know him submitting to the fatality of his nature, the rational inquiry is this—how best to order his life, and to use the eternity that he has. And an immortality of prolonged activity on earth he has as certainly as he has civilization, or progress, or society. And the wise man in the evening of life may be well content to say: "I have worked and thought, and have been conscious in the flesh; I have done with the flesh, and therewith with the toil of thought and the troubles of sensation; I am ready to pass into the spiritual community of human souls, and when this man's flesh wastes away from me, may I be found worthy to become part of the influence of humanity itself, and so

'. . . . join the choir invisible
Whose music is the gladness of the world.'"

That the doctrine of the celestial future appeals to the essence of self appears very strongly in its special rebuke to the doctrine of the social future. It repeats: "We agree with all you say about the prolonged activity of man after death, we see of course that the solid achievements of life are carried on, and we grant you that it signifies nothing to those who profit by his work that the man no longer breathes in the flesh: but what is all that to the *man*, to you, and to me? we shall not *feel* our work, we shall not have the indescribable satisfaction which our souls now have in living, in effecting our work, and profiting by others. What is the good of mankind to me, when I am mouldering unconscious?" This is the true materialism; here is the physical theory of another life; this is the unspiritual denial of the soul, the binding it down to the clay of the body. We say, "All that is great in you shall not end, but carry on its activity perpetually and in a purer way;" and you reply: "What care I for what is great in me, and its possible work in this vale of tears? I want to feel life, I want to enjoy, I want my personality"—in other words, "I want my senses, I want my body." Keep your body and keep your senses in any way that you know. We can only wonder and say, with Frederick to his runaway soldiers, "Wollt ihr immer leben?" But we, who know that a higher form of activity is only to be reached by a subjective life in society, will continue to regard a perpetuity of sensation as the true hell, for we feel that the perpetual worth of our lives is the one thing precious to care for, and not a vacuous eternity of consciousness.

It is not merely that this eternity of the tabor is so gross, so sensual, so indolent, so selfish a creed; but its worst evil is that it paralyzes practical life, and throws it into discord. A life of vanity in a vale of tears to be followed by an infinity of celestial rapture, is necessarily a life which is of infinitesimal importance. The incongruity of the attempts to connect the two, and to make the vale of tears the antechamber or the judgment-dock of heaven, grows greater and not less as ages roll on. The more we think and learn, and the higher rises our social philosophy and our insight into human destiny, the more the reality and importance of the social future impresses us, while the fancy of the celestial future grows unreal and incongruous. As we get to know what thinking means, and feeling means, and the more truly we understand what life means, the more completely do the promises of the celestial transcendentalism fail to interest us. We have come to see that to continue to live is to carry on a series of correlated sensations, and to set in motion a series of corresponding forces; to think is to marshal a set of observed perceptions with a view to certain observed phenomena; to feel implies something of which we have a real assurance affect-

ing our own consensus within. The whole set of positive thoughts compels us to believe that it is an infinite apathy to which your heaven would consign us, without objects, without relations, without change, without growth, without action, an absolute nothingness, a *nirvâna* of impotence —this is not life; it is not consciousness; it is not happiness. So far as we can grasp the hypothesis, it seems equally ludicrous and repulsive. You may call it paradise; but we call it conscious annihilation. You may long for it, if you have been so taught; just as if you had been taught to cherish such hopes, you might be now yearning for the moment when you might become the immaterial principle of a comet, or as you might tell me that you really were the ether, and were about to take your place in space. This is how these sublimities affect us. But we know that to many this future is one of spiritual development, a life of growth and continual upsoaring of still higher affection. It may be so; but to our mind these are contradictions in terms. We cannot understand what life and affection can mean, where you postulate the absence of every condition by which life and affection are possible. Can there be development where there is no law, thought or affection where object and subject are confused into one essence? How can that be existence, where everything of which we have experience, and everything which we can define, is presumed to be unable to enter? To us these things are all incoherences; and in the midst of practical realities and the solid duties of life, sheer impertinences. The field is full; each human life has a perfectly real and a vast future to look forward to; these hyperbolic enigmas disturb our grave duties and our solid hopes. No wonder, then, while they are still so rife, that men are dull to the moral responsibility which, in its awfulness, begins only at the grave; that they are so little influenced by the futurity which will judge them; that they are blind to the dignity and beauty of death, and shuffle off the dead life and the dead body with such cruel disrespect. The fumes of the celestial immortality still confuse them. It is only when an earthly future is the fulfillment of a worthy earthly life, that we can see all the majesty as well as the glory of the world beyond the grave; and then only will it fulfill its moral and religious purpose as the great guide of human conduct.—*Nineteenth Century.*

DRIFTING LIGHT-WAVES.

By RICHARD A. PROCTOR, B. A.

THE method of measuring the motion of very swiftly-traveling bodies by noting changes in the light-waves which reach us from them, one of the most remarkable methods of observation ever yet devised by man, has recently been placed upon its trial, so to speak, with results exceedingly satisfactory to the students of science who had accepted the facts established by it. The method will not be unfamiliar to many readers of these pages. The principle involved was first noted by M. Doppler, but not in a form which promised any useful results. The method actually applied appears to have occurred simultaneously to several persons, as well theorists as observers. Thus Secchi claimed in March, 1868, to have applied it, though unsuccessfully; Huggins, in April, 1868, described his successful use of the method. I, myself, wholly unaware that either of these observers was endeavoring to measure celestial motions by its means, described the method, in words which I shall presently quote, in the number of *Fraser's Magazine* for January, 1868, two months before the earliest enunciation of its nature by the physicists just named.

It will be well briefly to describe the principle of this interesting method, before considering the attack to which it has been recently subjected, and its triumphant acquittal from defects charged against it. This brief description will not only be useful to those readers who chance not to be acquainted with the method, but may serve to remove objections which suggest themselves, I notice, to many who have had the principle of the method imperfectly explained to them.

Light travels from every self-luminous body in waves which sweep through the ether of space at the rate of 185,000 miles per second. As I have elsewhere pointed out, "the whole of that region of space over which astronomers have extended their survey, and, doubtless, a region many millions of millions of times more extended,

may be compared to a wave-tossed sea, only that, instead of a wave-tossed surface, there is wave-tossed space." At every point, through every point, along every line, athwart every line, myriads of light-waves are at all times rushing with the inconceivable velocity just mentioned. It is from such waves that we have learned all we know about the universe outside our own earth. They bring to our shores news from other worlds, though the news is not always easy to decipher.

Now, seeing that we are thus immersed in an ocean, athwart which infinite series of waves are continually rushing, and, moreover, that we ourselves, and every one of the bodies whence the the waves proceed either directly or after reflection, are traveling with enormous velocity through this ocean, the idea naturally presents itself that we may learn something about these motions (as well as about the bodies themselves whence they proceed), by studying the aspect of the waves which flow in upon us in all directions. Suppose a strong swimmer who knew that, were he at rest, a certain series of waves would cross him at a particular rate—ten, for instance, in a minute—were to notice that, when he was swimming directly facing them, eleven passed him in a minute—he would be able at once to compare his rate of swimming with the rate of the waves' motion. He would know that while ten waves had passed him on account of the waves' motion, he had by his own motion caused yet another wave to pass him, or, in other words, had traversed the distance from one wave-crest to the next. Thus he would know that his rate was one-tenth that of the waves. Similarly if, traveling the same way as the waves, he found that only nine passed him in a minute, instead of ten. Again, it is not difficult to see that, if an observer were at rest, and a body in the water, which by certain motions produced waves, were approaching or receding from the observer, the waves would come in faster in the former case, slower in the latter, than if the body were at rest. Suppose, for instance, that some machinery at the bows of a ship raised waves which, if the ship were at rest, would travel along at the rate of ten a minute past the observer's station. Then, clearly, if the ship approached him, each successive wave would have a shorter distance to travel, and so would reach him sooner than it otherwise would have done. Suppose, for instance, the ship traveled one-tenth as fast as the waves, and consider ten waves proceeding from her bows — the first would have to travel a certain distance before reaching the observer; the tenth, starting a minute later, instead of having to travel the same distance, would have to travel this distance diminished by the space over which the ship had passed in one minute (which the wave itself passes over in the tenth of a minute); instead, then, of reaching the observer one minute after the other, it would reach him in nine-tenths of a minute after the first. Thus it would seem to him as though the waves were coming in faster than when the ship was at rest, in the proportion of ten to nine, though in reality they would be traveling at the same rate as before, only arriving in quicker succession, because of the continual shortening of the distance they had to travel, on account of the ship's approach. If he knew precisely how fast they *would* arrive if the ship were at rest, and determined precisely how fast they *did* arrive, he would be able to determine at once the rate of the ship's approach, at least the proportion between her rate and the rate of the wave's motion. Similarly if, owing to the ship's recession, the apparent rate of the waves' motion were reduced, it is obvious that the actual change in the wave-motion would not be a difference of rate; but, in the case of the approaching ship, the breadth from crest to crest would be reduced, while in the case of a receding ship the distance from crest to crest would be increased.

If the above explanation should still seem to require closer attention than the general reader may be disposed to give, the following, suggested by a friend of mine—a very skillful mathematician—will be found still simpler: Suppose a stream to flow quite uniformly, and that at one place on its banks an observer is stationed, while at another higher up a person throws corks into the water at regular intervals, say ten corks per minute: then these will float down and pass the other observer, wherever he may be, at the rate of ten per minute, *if* the cork-thrower is at rest. But if he saunters either up-stream or down-stream, the corks will no longer float past the other at the exact rate of ten per minute. If the thrower is sauntering down-stream, then, between throwing any cork and the next, he has walked a certain way down, and the tenth cork, instead of having to travel the same distance as the first before reaching the observer, has a shorter distance to travel, and so reaches that observer sooner. Or, in fact, which some may find easier to see, this cork will be nearer to the first cork than it would have been if the thrower had remained still. The corks will lie at equal distances from each other, but these equal distances will be less than they would have been if the observer had been at

rest. If, on the contrary, the cork-thrower saunters up-stream, the corks will be somewhat farther apart than if he had remained at rest. And, supposing the observer to know beforehand that the corks would be thrown in at the rate of ten a minute, he would know, if they passed him at a greater rate than ten a minute (or, in other words, at a less distance from each other than the stream traversed in the tenth of a minute), that the cork-thrower was traveling down-stream or approaching him; whereas if fewer than ten a minute passed him, he would know that the cork-thrower was traveling away from him, or up-stream. But also, if the cork-thrower were at rest, and the observer moved up-stream—that is, toward him—the corks would pass him at a greater rate than ten a minute; whereas if the observer were traveling down-stream, or from the thrower, they would pass him at a slower rate. If both were moving, it is easily seen that if their movement brought them nearer together, the number of corks passing the observer per minute would be increased; whereas if their movements set them farther apart, the number passing him per minute would be diminished.

These illustrations, derived from the motions of water, suffice in reality for our purpose. The waves which are emitted by luminous bodies in space travel onward like the water-waves or the corks of the preceding illustrations. If the body which emits them is rapidly approaching us the waves are set closer together or narrowed, whereas if the body is receding they are thrown farther apart or broadened. And, if we can in any way recognize such narrowing or broadening of the light-waves, we know just as certainly that the source of light is approaching us or receding from us as the case may be, as our observer in the second illustration would know from the distance between the corks whether his friend the cork-thrower was drawing nearer to him or traveling away from him.

But it may be convenient to give another illustration, drawn from waves which, like those of light, are not themselves discernible by our senses—I refer to those aërial waves of compression and rarefaction which produce what we call sound. These waves are not only in this respect better suited than water-waves to illustrate our subject, but also because they travel in all directions through aërial space, not merely along a surface. The waves which produce a certain note, that is, which excite in our minds, through the auditory nerve, the impression corresponding to a certain tone, have a definite length. So long as the observer, and a source of sound vibrating in one particular period, remain both in the same place, the note is unchanged in tone, though it may grow louder or fainter according as the vibrations increase or diminish in amplitude. But if the source of sound is approaching the hearer, the waves are thrown closer together and the sound is rendered more acute (the longer waves giving the deeper sound); and, on the other hand, if the source of sound is receding from the hearer, the waves are thrown farther apart, and the sound is rendered graver. The *rationale* of these changes is precisely the same as that of the changes described in the preceding illustrations. It might, perhaps, appear that in so saying we were dismissing the illustration from sound, at least as an independent one, because we are explaining the illustration by preceding illustrations. But in reality, while there is absolutely nothing new to be said respecting the increase and diminution of distances (as between the waves and corks of the preceding illustration), the illustration from sound has the immense advantage of admitting readily of experimental tests. It is necessary only that the rate of approach or recession should bear an appreciable proportion to the rate at which sound travels. For waves are shortened or lengthened by approach or recession by an amount which bears to the entire length of the wave the same proportion which the rate of approach or recession bears to the rate of the wave's advance. Now, it is not very difficult to obtain rates of approach or recession fairly comparable with the velocity of sound—about 364 yards per second. An express-train at full speed travels, let us say, about 1,800 yards per minute, or 30 yards per second. Such a velocity would suffice to reduce all the sound-waves proceeding from a bell or whistle upon the engine by about one-twelfth part for an observer at rest on a station-platform approached by the engine. On the contrary, after the engine had passed him, the sound-waves proceeding from the same bell or whistle would be lengthened by one-twelfth. The difference between the two tones would be almost exactly three semitones. If the hearer, instead of being on a platform, were in a train carried past the other at the same rate, the difference between the tone of the bell in approaching and its tone in receding would be about three tones. It would not be at all difficult so to arrange matters that, while two bells were sounding the same note—*mi*, let us say—one bell on one engine, the other on the other, a traveler by one should hear his

own engine's bell, the bell of the approaching engine, and the bell of the same engine receding, as the three notes, *do*, *mi*, *sol*, whose wave-lengths are as the numbers 15, 12, and 10. We have here differences very easily to be recognized even by those who are not musicians. Every one who travels much by train must have noticed how the tone of a whistle changes as the engine sounding it travels past. The change is not quite sharp, but very rapid, because the other engine does not approach with a certain velocity up to a definite moment and then recede with the same velocity. It could only do this by rushing through the hearer, which would render the experiment theoretically more exact but practically unsatisfactory. As it rushes past, instead of through him, there is a brief time during which the rate of approach is rapidly being reduced to nothing, followed by a similarly brief time during which the rate of recession gradually increases from nothing up to the actual rate of the engines' velocities added together. The change of tone may be thus illustrated :[1]

A B representing the sound of the approaching whistle, *B C* representing the rapid degradation of sound as the engine rushes close past the hearer, and *C D* representing the sound of the receding whistle. Where a bell is sounded on the engine, as in America, the effect is better recognized, as I had repeated occasion to notice during my travels in that country. Probably this is because the tone of a bell is in any case much more clearly recognized than the tone of a railway-whistle. The change of tone, as a clanging bell is carried swiftly past (by the combined motions of both trains), is not at all of such a nature as to require close attention for its detection.

However, the apparent variation of sound produced by rapid approach or recession has been tested by exact experiments. On a railway uniting Utrecht and Maarsen "were placed," the late Prof. Nichol wrote, "at intervals of something upward of a thousand yards, three groups of musicians, who remained motionless during the requisite period. Another musician on the railway sounded at intervals one uniform note; and its effect on the ears of the stationary musicians have been fully published. From these, certainly—from the recorded changes between grave and the more acute, and *vice versa*—confirming, even *numerically*, what the relative velocities might have enabled one to predict, it appears justifiable to conclude that the general theory is correct; and that the note of any sound may be greatly modified, if not wholly changed, by the velocity of the individual hearing it;" or, he should have added, by the velocity of the source of sound: perhaps more correct than either is the statement that the note may be altered by the approach or recession of the source of sound, whether that be caused by the motion of the sounding body, or of the hearer himself, or of both.

It is difficult, indeed, to understand how doubt can exist in the mind of any one competent to form an opinion on the matter, though, as we shall presently see, some students of science and one or two mathematicians have raised doubts as to the validity of the reasoning by which it is shown that a change should occur. That the reasoning is sound cannot, in reality, be questioned, and after careful examination of the arguments urged against it by one or two mathematicians, I can form no other opinion than that these arguments amount really but to an expression of inability to understand the matter. This may seem astonishing, but is explained when we remember that some mathematicians, by devoting their attention too particularly to special departments, lose, to a surprising degree, the power of dealing with subjects (even mathematical ones) outside their department. Apart from the soundness of the reasoning, the facts are unmistakably in accordance with the conclusion to which the reasoning points. Yet some few still entertain doubts, a circumstance which may prove a source of consolation to any who find themselves unable to follow the reasoning on which the effect of approach or recession on wave-lengths depends. Let such remember, however, that experiment in the case of the aërial waves producing sound accords perfectly with theory, and that the waves which produce light are perfectly analogous (so far as this particular point is concerned) with the waves producing sound.

Ordinary white light, and many kinds of colored light, may be compared with *noise*—that is, with a multitude of intermixed sounds. But light of one pure color may be compared to

[1] Even this statement is not mathematically exact If the rails are straight and parallel, the ratio of approach and recession of an engine on one line toward or from an engine on the other is never quite equal to the engines' velocities added together; but the difference amounts practically to nothing, except when the engines are near each other.

sound of one determinate note. As the aërial waves producing the effect of one definite tone are all of one length, so the ethereal waves producing light of one definite color are all of one length. Therefore, if we approach or recede from a source of light emitting such waves, effects will result corresponding with what has been described above for the case of water-waves and sound-waves. If we approach the source of light, or if it approaches us, the waves will be shortened; if we recede from it, or if it recedes from us, the waves will be lengthened. But the color of light depends on its wave-length precisely as the tone of sound depends on its wave-length. The waves producing red light are longer than those producing orange light, these are longer than the waves producing yellow light; and so the length-waves shorten down from yellow to green, thence to blue, to indigo, and finally to violet. Thus if light shining in reality with a pure green color approached the observer with a velocity comparable with that of light, it would seem blue, indigo, or violet, according to the rate of approach; whereas if it rapidly receded, it would seem yellow, orange, or red, according to the rate of recession.

Unfortunately in one sense, though very fortunately in many much more important respects, the rates of motion among the celestial bodies are *not* comparable with the velocity of light, but are always so much less as to be almost rest by comparison. The velocity of light is about 187,000 miles per second, or, according to the measures of the solar system at present in vogue (which will shortly have to give place to somewhat larger measures, the result of observations made upon the recent transit of Venus), about 185,000 miles per second. The swiftest celestial motion of which we have ever had direct evidence was that of the comet of the year 1843, which, at the time of its nearest approach to the sun, was traveling at the rate of about 350 miles per second. This, compared with the velocity of light, is as the motion of a person taking six steps a minute, each less than half a yard long, to the rush of the swiftest express-train. No body within our solar system can travel faster than this, the motion of a body falling upon the sun from an infinite distance being only about 370 miles per second when it reaches his surface. And though swifter motions probably exist among the bodies traveling around more massive suns than ours, yet of such motions we can never become cognizant. All the motions taking place among the stars themselves would appear to be very much less in amount. The most swiftly moving sun seems to travel but at the rate of about 50 or 60 miles per second.

Now let us consider how far a motion of 100 miles per second might be expected to modify the color of pure green light—selecting green as the middle color of the spectrum. The waves producing green light are of such a length, that 47,000 of them scarcely equal in length a single inch. Draw on paper an inch and divide it carefully into ten equal parts, or take such parts from a well-divided rule; divide one of these tenths into ten equal parts, as nearly as the eye will permit you to judge; then one of these parts, or about half the thickness of an average pin, would contain 475 of the waves of pure green light. The same length would equal the length of 440 waves of pure yellow light, and of 511 waves of pure blue light. (The green, yellow, and blue, here spoken of, are understood to be of the precise color of the middle of the green, yellow, and blue parts of the spectrum.) Thus the green waves must be increased in the proportion of 475 to 440 to give yellow light, or reduced in the proportion of 511 to 475 to give blue light. For the first purpose, the velocity of recession must bear to the velocity of light the proportion which 30 bears to 475, or must be equal to rather more than one-sixteenth part of the velocity of light—say 11,600 miles per second. For the second purpose, the velocity of approach must bear to the velocity of light the proportion which 36 bears to 475, or must be nearly equal to one-thirteenth part of the velocity of light—say 14,300 miles per second. But the motions of the stars and other celestial bodies, and also the motions of matter in the sun, and so forth, are very much less than these. Except in the case of one or two comets (and always dismissing from consideration the amazing apparent velocities with which comets' tails *seem* to be formed), we may take 100 miles per second as the extreme limit of velocity with which we have to deal in considering the application of our theory to the motions of recession and approach of celestial bodies. Thus, in the case of recession the greatest possible change of color in pure green light would be equivalent to the difference between the medium green of the spectrum, and the color $\frac{1}{116}$ part of the way from medium green to medium yellow; and in the case of approach, the change would correspond to the difference between the medium green and the color $\frac{1}{143}$ part of the way from medium green to medium blue. Let any

one look at a spectrum of fair length, or even at a correctly-tinted painting of the solar spectrum, and note how utterly unrecognizable to ordinary vision is the difference of tint for even the twentieth part of the distance between medium green and medium yellow on one side, or medium blue on the other, and he will recognize how utterly hopeless it would be to attempt to appreciate the change of color due to the approach or recession of a luminous body shining with pure green light and moving at the tremendous rate of 100 miles per second. It would be hopeless, even though we had the medium green color and the changed color, either toward yellow or toward blue, placed side by side for comparison — how much more when the changed color would have to be compared with the observer's recollection of the medium color, as seen on some other occasion!

But this is the least important of the difficulties affecting the application of this method by noting change of color, as Doppler originally proposed. Another difficulty, which seems somehow to have wholly escaped Doppler's attention, renders the color-test altogether unavailable. We do not get *pure* light from any of the celestial bodies except certain gaseous clouds of nebulæ. From every sun we get, as from our own sun, all the colors of the rainbow. There may be an excess of some colors and a deficiency of others in any star, so as to give the star a tint, or even a very decided color. But even a blood-red star, or a deep blue or violet star, does not shine with pure red light, for the spectroscope shows that the star has other colors than those producing the prevailing tint, and it is only the great *excess* of red rays (all kinds of red, too) or of blue rays (of all kinds), and so on, which makes the star appear red, or blue, and so on, to the eye. By far the greater number of stars or suns show all the colors of the rainbow nearly equally distributed, as in the case of our own sun. Now, imagine for a moment a white sun, which had been at rest, to begin suddenly to approach us so rapidly (traveling more than 10,000 miles per second) that the red rays became orange, the orange became yellow, the yellow green, the green blue, the blue indigo, the indigo violet, and that the violet waves became too short to affect the sense of sight. Then, *if that were all*, that sun, being deprived of the red part of its light, would shine with a slightly-bluish tinge, owing to the relative superabundance of rays from the violet end of the spectrum. We should be able to recognize such a change, yet not nearly so distinctly as if that sun had been shining with a pure green light, and, suddenly beginning to approach us at the enormous rate just mentioned, changed in color to full blue. *Though*, if that sun were all the time approaching us at the enormous rate imagined, we should be quite unable to tell whether its slightly-bluish tinge were due to such motion of approach or to some inherent blueness in the light emitted by the star. Similarly, if a white sun suddenly began to recede so rapidly that its violet rays were turned to indigo, indigo to blue, and so on, the orange rays turning to red, and the red rays disappearing altogether, then, *if that were all*, its light would become slightly reddish, owing to the relative superabundance of light from the red end of the spectrum; and we might distinguish the change, yet not so readily as if a sun shining with pure green light began to recede at the same enormous rate, and so shone with pure yellow light. *Though*, if that sun were all the time receding at that enormous rate, we should be quite unable to tell whether its slightly-reddish hue were due to such motion of recession or to some inherent redness in its own lustre. *But in neither case would that be all.* In the former, the red rays would indeed become orange; but the rays beyond the red, which produce no effect upon vision, would be converted into red rays, and fill up the part of the spectrum deserted by the rays originally red. In the latter, the violet rays would indeed become indigo; but the rays beyond the violet, ordinarily producing no effect, would be converted into violet rays, and fill up the part of the spectrum deserted by the rays originally violet. Thus, despite the enormous velocity of approach in one case and of recession in the other, there would be no change whatever in the color of the sun in either case. All the colors of the rainbow would still be present in the sun's light, and it would, therefore, still be a white sun.

Doppler's method would thus fail utterly, even though the stars were traveling hither and thither with motions a hundred times greater than the greatest known stellar motions.

This objection to Doppler's theory, as originally proposed, was considered by me in an article on "Colored Suns" in *Fraser's Magazine* for January, 1868. His theory, indeed, was originally promulgated, not as affording a means of measuring stellar motions, but as a way of accounting for the colors of double stars. It was thus presented by Prof. Nichol, in a chapter of his "Architecture of the Heavens," on this special subject:

"The rapid motion of light reaches indeed one

of those numbers which reason owns, while imagination ceases to comprehend them; but it is also true that the swiftness with which certain individuals of the double stars sweep past their perihelia, or rather their periasters, is amazing; and, in this matter of colors, it must be recollected that the question solely regards the difference between the velocity of the waves constituent of colors, at those different stellar positions. Still it is a bold—even a magnificent idea; and if it can be reconciled with the permanent colors of the multitude of stars surrounding us—stars which too are moving in great orbits with immense velocities—it may be hailed almost as a positive discovery. It must obtain confirmation, or otherwise, so soon as we can compare with certainty the observed colorific changes of separate systems with the known fluctuations of their orbital motions."

That was written a quarter of a century ago, when spectroscopic analysis, as we now know it, had no existence. Accordingly, while the fatal objection to Doppler's original theory is overlooked on the one hand, the means of applying the principle underlying the theory, in a much more exact manner than Doppler could have hoped for, is overlooked on the other. Both points are noted in the article above referred to, in the same paragraph. "We may dismiss," I there stated, "the theory started some years ago by the French astronomer, M. Doppler." But, I presently added, "It is quite clear that the effects of a motion rapid enough to produce such a change" (i. e., a change of tint in a pure color) "would shift the position of the whole spectrum—and this change would be readily detected by a reference to the spectral lines." This is true, even to the word "readily." Velocities which would produce an appreciable change of tint would produce "readily" detectible changes in the position of the spectral lines; the velocities actually existing among the star-motions would produce changes in the position of these lines detectible only with extreme difficulty, or perhaps in the majority of instances not detectible at all.

It has been in this way that the spectroscopic method has actually been applied.

It is easy to perceive the essential difference between this way of applying the method and that depending on the attempted recognition of changes of color. A dark line in the spectrum marks in reality the place of a missing tint. The tints next to it on either side are present, but the tint between them is wanting. They are changed in color—very slightly, in fact quite inappreciably—by motion of recession or approach, or, in other words, they are shifted in position along the spectrum, toward the red end for recession, toward the violet end for approach; and, of course, the dark space between is shifted along with them. One may say that the missing tint is changed. For in reality that is precisely what would happen. If the light of a star at rest gave every tint of the spectrum, for instance, except mid-green alone, and that star approached or receded so swiftly that its motion would change pure green light to pure yellow in one case, or pure blue in the other, then the effect on the spectrum of such a star would be to throw the dark line from the middle of the green part of the spectrum to the middle of the yellow part in one case, or to the middle of the blue part in the other. The dark line would be quite notably shifted in either case. With the actual stellar motions, though all the lines are more or less shifted, the displacement is always exceedingly minute, and it becomes a task of extreme difficulty to recognize, and still more to measure, such displacement.

When I first indicated publicly (January, 1868) the way in which Doppler's principle could alone be applied, two physicists, Huggins in England and Secchi in Italy, were actually endeavoring, with the excellent spectroscopes in their possession, to apply this method. In March, 1868, Secchi gave up the effort as useless, publicly announcing the plan on which he had proceeded, and his failure to obtain any results except negative ones. A month later Huggins also publicly announced the plan on which he had been working, but was also able to state that in one case, that of the bright star Sirius, he had succeeded in measuring a motion in the line of sight, having discovered that Sirius was receding from the earth at the rate of 41.4 miles per second. I say *was* receding, because a part of the recession at the time of observation was due to the earth's orbital motion around the sun. I had, at his request, supplied Huggins with the formula for calculating the correction due to this cause, and, applying it, he found that Sirius is receding from the sun at the rate of about 29½ miles per second, or some 930,000,000 miles per annum.

I am not here specially concerned to consider the actual results of the application of this method since the time of Huggins's first success; but the next chapter of the history of the method is one so interesting to myself personally that I feel tempted briefly to refer to details. So soon as I had heard of Huggins's success with Sirius, and that an instrument was being prepared for him wherewith he might hope to extend the method

to other stars, I ventured to make a prediction as to the result which he would obtain whensoever he should apply it to five stars of the seven forming the so-called Plough. I had found reason to feel assured that these five form a system drifting all together amid stellar space. Satisfied for my own part as to the validity of the evidence, I submitted it to Sir J. Herschel, who was struck by its force. The apparent drift of those stars was, of course, a thwart-drift; but if they really were drifting in space, then their motions in the line of sight must of necessity be alike. My prediction, then, was that whensoever Mr. Huggins applied to those stars the new method he would find them either all receding at the same rate, or all approaching at the same rate, or else that all *alike* failed to give any evidence at all either of recession or approach. I had indicated the five in the first edition of my "Other Worlds"—to wit, the stars of the Plough, omitting the nearest "pointer" to the pole and the star marking the third horse (or the tip of the Great Bear's tail). So soon as Huggins's new telescope and its spectroscopic adjuncts were in working order, he reexamined Sirius, determined the motions of other stars, and, at last, on one suitable evening he tested the stars of the Plough. He began with the nearest pointer, and found that star swiftly approaching the earth. He turned to the other pointer, and found it rapidly receding from the earth. Being under the impression that my five included both pointers, he concluded that my prediction had utterly failed, and so went on with his observations altogether unprejudiced in its favor, to say the least. The next star of the seven he found to be receding at the same rate as the second pointer; the next at the same rate; the next, and the next, receding still at the same rate, and lastly the seventh receding at a different rate. Here, then, were five stars, all receding at a common rate, and of the other two one receding at a different rate, the other swiftly approaching. Turning next to the work containing my prediction, Huggins found that the five stars thus receding at a common rate were the five whose community of motion I had indicated two years before. Thus the first prediction ever made respecting the motions of the so-called fixed stars was not wanting in success. I would venture to add that the theory of star-drift, on the strength of which the prediction was made, was effectively confirmed by the result.

The next application of the new method was one of singular interest. I believe it was Mr. Lockyer who first thought of applying the method to measure the rate of solar hurricanes as well as the velocities of the up-rush and down-rush of vaporous matter in the atmosphere of the sun. Another spectroscopic method had enabled astronomers to watch the rush of glowing matter from the edge of the sun, by observing the colored flames and their motions; but by the new method it was possible to determine whether the flames at the edge were swept by solar cyclones carrying them from or toward the eye of the terrestrial observer, and also to determine whether glowing vapors over the middle of the visible disk were subject to motion of up-rush, which of course would carry them toward the eye, or of down-rush, which would carry them from the eye. The result of observations directed to this end was to show that at least during the time when the sun is most spotted, solar hurricanes of tremendous violence take place, while the up-rushing and down-rushing motions of solar matter sometimes attain a velocity of more than 100 miles per second.

It was this success on the part of an English spectroscopist which caused the attack on the new method against which it has but recently been successfully defended, at least in the eyes of those who are satisfied only by experimental tests of the validity of a process. The Padre Secchi had failed, as we have seen, to recognize motions of recession and approach among the stars by the new method. But he had taken solar observation by spectroscopic methods under his special charge, and therefore when the new results reached his ears he felt bound to confirm or invalidate them. He believed that the apparent displacement of dark lines in the solar spectrum might be due to the heat of the sun causing changes in the delicate adjustments of the instrument—a cause of error against which precautions are certainly very necessary. He satisfied himself that when sufficient precautions are taken no displacements take place such as Lockyer, Young, and others, claimed to have seen. But he submitted the matter to a further test. As the sun is spinning swiftly on his axis, his mighty equator, more than 2,500,000 miles in girth, circling once round in about twenty-four days, it is clear that on one side the sun's surface is swiftly moving *toward*, and on the other side as swiftly moving *from*, the observer. By some amazing miscalculation Secchi made the rate of this motion twenty miles per second, so that the sum of the two motions in opposite directions would equal forty miles per second. He considered that he ought to be able by the new method, if

the new method is trustworthy at all, to recognize this marked difference between the state of the sun's eastern and western edges; found on trial that he could not do so; and accordingly expressed his opinion that the new method is not trustworthy, and that the arguments urged in its favor are invalid.

The weak point in his reasoning resided in the circumstance that the solar equator is only moving at the rate of about one and a quarter mile per second, so that instead of a difference of forty miles per second between the two edges, which should be appreciable, the actual difference (that is, the sum of the two equal motions in opposite directions) amounts only to two and a half miles per second, which certainly Secchi could not hope to recognize with the spectroscopic power at his disposal. Nevertheless, when the error in his reasoning was pointed out, though he admitted that error, he maintained the justice of his conclusion; just as Cassini, having mistakenly reasoned that the degrees of latitude should diminish toward the pole instead of increasing, and having next mistakenly found, as he supposed, that they do diminish, acknowledged the error of his reasoning, but insisted on the validity of his observations; maintaining thenceforth, as all the world knows, that the earth is extended instead of flattened at the poles!

Huggins tried to recognize by the new method the effects of the sun's rotation, using a much more powerful spectroscope than Secchi had employed. The history of the particular spectroscope he employed is in one respect specially interesting to myself, as the extension of spectroscopic power was of my own devising before I had ever used or even seen a powerful spectroscope. The reader is aware that spectroscopes derive their light-sifting power from the prisms forming them. The number of prisms was gradually increased, from Newton's single prism to Fraunhofer's pair, Kirchhoff's battery of four, till six were used, which bent the light round as far as it would go. Then the idea occurred of carrying the light to a higher level (by reflections) and sending it back through the same battery of prisms, doubling the dispersion. Such a battery, if of six prisms, would spread the spectral colors twice as widely apart as six used in the ordinary way, and would thus have a dispersive power of twelve prisms. It occurred to me that after taking the rays through six prisms, arranged in a curve like the letter C, an intermediate four-cornered prism of a particular shape (which I determined) might be made to send the rays into another battery of six prisms, the entire set forming a double curve like the letter S, the rays being then carried to a higher level and back through the double battery. In this way a dispersive power of nineteen prisms could be secured. My friend Mr. Browning, the eminent optician, made a double battery of this kind,[1] which was purchased by Mr. W. Spottiswoode, and by him lent to Mr. Huggins for the express purpose of dealing with the task Secchi had set spectroscopists. It did not, however, afford the required evidence. Huggins considered the displacement of dark lines due to the sun's rotation to be recognizable, but so barely that he could not speak confidently on the point.

There for a while the matter rested. Vögel made observations confirming Huggins's results relative to stellar motions; but Vögel's instrumental means were not sufficiently powerful to render his results of much weight.

But recently two well-directed attacks have been made upon this problem, one in England, the other in America, and in both cases with success. Rather, perhaps, seeing that the method had been attacked and was supposed to require defense, we may say that two well-directed assaults have been made upon the attacking party, which has been completely routed.

Arrangements were made not very long ago, by which the astronomical work of Greenwich Observatory, for a long time directed almost exclusively to time observations, should include the study of the sun, stars, planets, and so forth. Among other work which was considered suited to the national observatory was the application of spectroscopic analysis to determine motions of recession and approach among the celestial bodies. Some of these observations, by-the-way, were made, we are told, "to test the truth of Doppler's principle," though it seems difficult to suppose for an instant that mathematicians so skillful as the chief of the observatory and some of his assistants could entertain any doubt on that point. Probably it was intended by the words just quoted to imply simply that some of the observations were made for the purpose of

[1] I have omitted all reference to details; but in reality the double battery was automatic, the motion of the observing telescope, as different colors of the spectrum were brought into view, setting all the prisms of the double battery into that precise position which causes them to show best each particular part of the spectrum thus brought into view. It is rather singular that the first view I ever had of the solar prominences was obtained (at Dr. Huggins's observatory) with this instrument of my own invention, which also was the first powerful spectroscope I had ever used or even seen.

illustrating the principle of the method. We are not to suppose that on a point so simple the Greenwich observers have been in any sort of doubt.

At first their results were not very satisfactory. The difficulties which had for a long time foiled Huggins, and which Secchi has never been able to master, rendered the first Greenwich measures of stellar motions in the line of sight wildly inconsistent, not only with Huggins's results, but with each other. Secchi was not slow to note this, and a short time ago he renewed his objections to the new method of observation, pointing and illustrating his objections by referring to the discrepancies among the Greenwich results. But recently a fresh series of results has been published, showing that the observers at Greenwich have succeeded in mastering some at least among the difficulties which they had before experienced. The measurements of star-motions showed now a satisfactory agreement with Huggins's results, and their range of divergence among themselves was greatly reduced. The chief interest of the new results, however, lay in the observations made upon bodies known to be in motion in the line of sight at rates already measured. These observations, though not wanted as tests of the accuracy of the principle, were very necessary as tests of the accuracy of the instruments used in applying it. It is here and thus that Secchi's objections alone required to be met, and here and thus they have been thoroughly disposed of. Let us consider what means exist within the solar system for thus testing the new method.

The earth travels along in her orbit at the rate of about eighteen and one-third miles in every second of time. Not to enter into niceties which could only properly be dealt with mathematically, it may be said that with this full velocity she is at times approaching the remoter planets of the system, and at times receding from them; so that here at once is a range of difference amounting to about thirty-seven miles per second, and fairly within the power of the new method of observation. For it matters nothing, so far as the new method is concerned, whether the earth is approaching another orb by her motion, or that orb approaching by its own motion. Again, the planet Venus travels at the rate of about twenty-one and a half miles per second, but as the earth travels only three miles a second less swiftly, and the same way round, only a small portion of Venus's motion ever appears as a motion of approach toward or recession from the earth. Still, Venus is sometimes approaching and sometimes receding from the earth, at a rate of more than eight miles per second. Her light is much brighter than that of Jupiter or Saturn, and accordingly this smaller rate of motion would be probably more easily recognized than the greater rate at which the giant planets are sometimes approaching and at other times receding from the earth. At least the Greenwich observers seem to have confined their attention to Venus, so far as motions of planets in the line of sight are concerned. The moon, as a body which keeps always at nearly the same distance from us, would, of course, be the last in the world to be selected to give positive evidence in favor of the new method; but she serves to afford a useful test of the accuracy of the instruments employed. If, when these were applied to her, they gave evidence of motions of recession or approach at the rate of several miles per second, when we know as a matter of fact that the moon's distance never[1] varies by more than 30,000 miles during the lunar month, and her rate of approach or recession thus averaging about one-fiftieth part of a mile per second, discredit would be thrown on the new method—not, indeed, as regards its principle, which no competent reasoner can for a moment question, but as regards the possibility of practically applying it with our present instrumental means.

Observations have been made at Greenwich, both on Venus and on the moon, by the new method, with results entirely satisfactory. The method shows that Venus is receding when she is known to be receding, and that she is approaching when she is known to be approaching; and the method shows no signs of approach or recession in the moon's case, and is thus in satisfactory agreement with the known facts. Of course, these results are open to the objection that the observers have known beforehand what to expect, and that expectation often deceives the mind, especially in cases where the thing to be observed is not at all easy to recognize. It will presently be seen that the new method has been more satisfactorily tested, in this respect, in other ways. It may be partly due to the effect of expectation that in the case of Venus the motions of approach and recession, tested by the new method, have always been somewhat too great. A part of the excess may be due to the use of the measure of the sun's distance, and

[1] It varies more in some months than in others, as the moon's orbit changes in shape under the various perturbing influences to which she is subject.

therefore the measures of the dimensions of the solar system, in vogue before the recent transit. These measures fall short to some degree of those which result from the observations made in December, 1874, on Venus in transit, the sun's distance being estimated at about 91,400,000 miles instead of 92,000,000 miles, which would seem to be nearer the real distance. Of course, all the motions within the solar system would be correspondingly under-estimated. On the other hand, the new method would give all velocities with absolute correctness if instrumental difficulties could be overcome. The difference between the real velocities of Venus approaching and receding, and those calculated according to the present inexact estimate of the sun's distance, is, however, much less than the observed discrepancy, doubtless due to the difficulties involved in the application of this most difficult method. I note the point, chiefly for the sake of mentioning the circumstance that theoretically the method affords a new means of measuring the dimensions of the solar system. Whensoever the practical application of the method has been so far improved that the rate of approach or recession of Venus, or Mercury, or Jupiter, or Saturn (any of these planets), can be determined on any occasion, with great nicety, we can at once infer the sun's distance with corresponding exactness. Considering that the method has not been invented ten years (setting aside Doppler's first vague ideas respecting it), and that spectroscopic analysis as a method of exact observation is as yet little more than a quarter of a century old, we may fairly hope that in the years to come the new method, already successfully applied to measure motions of recession and approach at the rate of twenty or thirty miles per second, will be employed successfully in measuring much smaller velocities. Then will it give us a new method of measuring the great base-line of astronomical surveying—the distance of our world from the centre of the solar system.

That this will one day happen is rendered highly probable, in my opinion, by the successes next to be related.

Besides the motions of the planets around the sun, there are their motions of rotation, and the rotation of the sun himself upon his axis. Some among these turning motions are sufficiently rapid to be dealt with by the new method. The most rapid rotational motion with which we are acquainted from actual observation is that of the planet Jupiter. The circuit of his equator amounts to about 267,000 miles, and he turns once on his axis in a few minutes less than ten hours, so that his equatorial surface travels at the rate of about 26,700 miles an hour, or nearly seven and a half miles per second. Thus, between the advancing and retreating sides of the equator there is a difference of motion in the line of sight amounting to nearly fifteen miles. But this is not all. Jupiter shines by reflecting sunlight. Now, it is easily seen that where his turning equator *meets* the waves of light from the sun, these are shortened, in the same sense that waves are shortened for a swimmer traveling to meet them, while these waves, already shortened in this way, are further shortened when starting from the same advancing surface of Jupiter, on their journey to us after reflection. In this way, the shortening of the waves is doubled, at least when the earth is so placed that Jupiter lies in the same direction from us as from the sun, the very time, in fact, when Jupiter is most favorably placed for ordinary observation, or at his highest due south, when the sun is at his lowest below the northern horizon—that is, at midnight. The lengthening of the waves is similarly doubled at this most favorable time for observation; and the actual difference between the motion of the two sides of Jupiter's equator being nearly fifteen miles per second, the effect on the light-waves is equivalent to that due to a difference of nearly thirty miles per second. Thus, the new method may fairly be expected to indicate Jupiter's motion of rotation. The Greenwich observers have succeeded in applying it, though Jupiter has not been favorably situated for observation. Only on one occasion, says Sir G. Airy, was the spectrum of Jupiter "seen fairly well," and on that occasion "measures were obtained which gave a result in remarkable agreement with the calculated value." It may well be hoped that when in the course of a few years Jupiter returns to that part of his course where he rises high above the horizon, shining more brightly and through a less perturbed air, the new method will be still more successfully applied. We may even hope to see it extended to Saturn, not merely to confirm the measures already made of Saturn's rotation, but to resolve the doubts which exist as to the rotation of Saturn's ring-system.

Lastly, there remains the rotation of the sun, a movement much more difficult to detect by the new method, because the actual rate of motion even at the sun's equator amounts only to about one mile per second.

In dealing with this very difficult task, the hardest which spectroscopists have yet attempted,

the Greenwich observers have achieved an undoubted success; but unfortunately for them, though fortunately for science, another observatory, far smaller and of much less celebrity, has at the critical moment achieved success still more complete.

The astronomers at our national observatory have been able to recognize by the new method the turning-motion of the sun upon his axis. And here we have not, as in the case of Venus, to record merely that the observers have seen what they expected to see because of the known motion of the sun. "Particular care was taken," says Airy, "to avoid any bias from previous knowledge of the direction in which a displacement" (of the spectral lines) "was to be expected," the side of the sun under observation not being known by the observer until after the observation was completed.

But Prof. Young, at Dartmouth College, Hanover, New Hampshire, has done much more than merely obtain evidence by the new method that the sun is rotating as we already knew. He has succeeded so perfectly in mastering the instrumental and observational difficulties, as absolutely to be able to rely on his *measurement* (as distinguished from the mere recognition) of the sun's motion of rotation. The manner in which he has extended the powers of ordinary spectroscopic analysis cannot very readily be described in these pages, simply because the principles on which the extension depends require for their complete description a reference to mathematical considerations of some complexity. Let it be simply noted that what is called the diffractive spectrum, obtained by using a finely-lined plate, results from the dispersive action of such a plate, or *grating*, as it is technically called, and this dispersive power can be readily combined with that of a spectroscope of the ordinary kind. Now, Dr. Rutherford, of New York, has succeeded in ruling so many thousand lines on glass within the breadth of a single inch as to produce a grating of high dispersive power. Availing himself of this beautiful extension of spectroscopic powers, Prof. Young has succeeded in recognizing effects of much smaller motions of recession and approach than had before been observable by the new method. He has thus been able to measure the rotation-rate of the sun's equatorial regions. His result exceeds considerably that inferred from the telescopic observation of the solar spots. For, whereas from the motion of the spots a rotation-rate of about one and a quarter mile per second has been calculated for the sun's equator, Prof. Young obtains from his spectroscopic observations a rate of rather more than one and two-fifths mile, or about 300 yards per second more than the telescopic rate.

If Young had been measuring the motion of the same matter which is observed with the telescope, there could of course be no doubt that the telescope was right, and the spectroscope wrong. We might add a few yards per second for the probably greater distance of the sun resulting from recent transit observations. For, of course, with an increase in our estimate of the sun's distance there comes an increase in our estimate of the sun's dimensions, and of the velocity of the rotational motion of his surface; but only about twelve yards per second could be allowed on this account, the rest would have to be regarded as an error due to the difficulties involved in the spectroscopic method. But in reality the telescopist and the spectroscopist observe different things in determining by their respective methods the sun's motion of rotation. The former observes the motion of the spots belonging to the sun's visible surface; the latter observes the motion of the glowing vapors outside that surface, for it is from these vapors, not from the surface of the sun, that the dark lines of the spectrum proceed. Now, so confident is Prof. Young of the accuracy of his spectroscopic observations, that he is prepared to regard the seeming difference of velocity between the atmosphere and surface of the sun as real. He believes that "the solar atmosphere really sweeps forward over the underlying surface in the same way that the equatorial regions outstrip the other parts of the sun's surface." This inference, important and interesting in itself, is far more important in what it involves. For, if we can accept it, it follows that the spectroscopic method of measuring the velocity of motions in the line of sight is competent, under favorable conditions, to obtain results accurate within a few hundred yards per second, or ten or twelve miles per minute. If this shall really prove to be true for the method now, less than nine years after it was first successfully applied, what may we not hope from the method in future years? Spectroscopic analysis itself is in its infancy, and this method is but a recent application of spectroscopy. A century or so hence astronomers will smile (though not disdainfully) at these feeble efforts, much as we smile now in contemplating the puny telescopes with which Galileo and his contemporaries studied the star-depths. And we may well believe that largely as the knowledge gained by

telescopists in our own time surpasses that which Galileo obtained, so will spectroscopists a few generations hence have gained a far wider and deeper insight into the constitution and movements of the stellar universe than the spectroscopists of our own day dare even hope to attain. I venture confidently to predict that, with that insight, astronomers will recognize in the universe of stars a variety of structure, a complexity of arrangement, an abundance of every form of cosmical vitality, such as I have been led by other considerations to suggest, not the mere cloven lamina of uniformly scattered stars more or less resembling our sun, and all in nearly the same stage of cosmical development, which the books of astronomy not many years since agreed in describing. The history of astronomical progress does not render it probable that the reasoning already advanced, though in reality demonstrative, will convince the generality of science-students until direct and easily-understood observations have shown the real nature of the constitution of that part of the universe over which astronomical survey extends. But the evidence already obtained, though its thorough analysis may be "*caviare* to the general," suffices to show the real nature of the relations which one day will come within the direct scope of astronomical observation.

—*Contemporary Review.*

COST OF MINERAL TRAFFIC ON ENGLISH RAILWAYS.[1]

By F. R. CONDER, C. E.

WE have seen, in a former paper, that the killed and wounded on railways of the United Kingdom, during the year 1875, amounted to the considerable number of 7,045 persons, and that grave reasons exist for attributing a large proportion of this loss to the result of the mutual interference of two different systems of traffic, carried over one system of road. To the data cited in our last number, chiefly from the reports of the Government Inspector of Railways, may be advantageously added one or two further details, taken from the report of the Royal Commission on railway accidents.

The annually increasing rate of railway danger could be only imperfectly illustrated by remarks for which Captain Tyler's report supplied material. It is therefore important to mention that between 1872 and 1875 there was an increase of between 40 and 41 per cent. in the annual list of casualties; the number in the former years having been 4,183, of which 1,145 were fatal. But while such has been the general increase, the servants of the railway companies have suffered from it far more severely than the general public; casualties among them having increased from 2,032 in 1872 to 4,383 in 1875, or by 115 per cent. in three years.

It should further be remarked that, although it is easy to show that a certain minimum proportion of these casualties are directly attributable to the cause already suggested, it is not easy to limit the maximum proportion so caused. Thus, while it is immediately apparent, on a glance at the "Summary of Accidents" which is to be found on page 87 of the report of the Royal Commission, that 65 per cent. of the casualties caused by collisions are directly due to the interference of passenger and goods or mineral trains, it is not apparent what proportion of the five per cent. of casualties caused by collisions of slow trains with slow trains, or of the remaining 30 per cent. caused by collisions of fast trains with fast

[1] The question handled in this paper has long seemed to us one of great importance, and we are glad to present the views of a writer qualified to deal with it. It may well be that our railway system stands in urgent need of a sweeping measure of reform, and that immediate steps ought to be taken to remove the mineral traffic (and perhaps all heavy-goods traffic) from railway lines used for the conveyance of passengers; such traffic to be in future carried on by sea, by inland waters, and by railway lines not used for passengers. Our railway system is emphatically the child of Parliament, and Parliament has every right to interfere with it to any extent for the public good. Even for the profit of the companies, a manner of conducting railway-traffic not proved necessary, and proved to cause annually a large number of cases of death and mutilation, could, we hold, have no claim to continue its murderous course. But our professional friend thinks it will appear, on a thorough examination, that this mixed traffic is actually carried on at a money loss, as well as a life-and-limb loss, not to speak of the losses in time, temper, and comfort, caused by daily and hourly unpunctuality. In connection with this article ought to be read "Battles of Peace" in our last, and "Our Inland Navigation" in the number for April.—Ed. *Fraser's Magazine.*

trains, is primarily due to the general derangement caused by the mutual interference of fast and slow traffic.

Again, while it is evident on the first glance that 57 per cent. of the casualties affecting railway servants from 1872 to 1875 are due to the three special causes of shunting, injury by falling between engines, and wagons, and vans, and loading or unloading goods, there is not one of the remaining fourteen causes of accident which can be exclusively attributed to the fast traffic taken apart. Positive data give the proportions we have cited with regard to classified accidents alone. As to the unclassified accidents, our best guide will be found in comparing the danger-rate of the lines when the traffic is principally of one description with that of the lines of mixed traffic. The result of this comparison is the inference that perfectly unmixed traffic can be carried on with an almost inappreciable risk to human life, as in the case of the Metropolitan Railway, with one casualty to 10,000,000 passengers, or of the Taff Vale Railway, carrying more than 4,000,000 tons of minerals, without a casualty mentioned in the report of Captain Tyler. From these considerations, it is clear that the proportion of casualties already attributed to the interference of the two descriptions of traffic is probably far below the truth. The chief difference which strikes the investigators as to the main causes of accident to the railway-passenger, and that to the railway-servant, is, that the former appears to be the intermixture of traffic directly regarded, while the latter is more distinctly traceable to the mineral traffic itself, although the fatal nature of that business is probably chiefly due to the rapidity with which all operations have to be carried on under the pressure of the partial occupation of the line and the station-yards by the rapid passenger-trains.

It is now desirable to inquire as to the benefit derived by the railway companies, in a pecuniary view, from that mode of accumulating traffic to which, to say the least, we may attribute from 66 to 96 per cent. of an annually augmenting list of casualties. In other words, what is the net pecuniary result of the mineral traffic of the railways of the United Kingdom?

This simple and pertinent question is as yet wholly unanswered. The managers and directors of our railways maintain a discreet silence on the subject. The Board of Trade returns shed but little light upon it. The latest and most elaborate analyst of our railway returns says: "It is rather humiliating that, after fifty years' experience of railways, we have no data of, or hardly even the means of approximating, the intrinsic loss and gain per passenger and per ton of goods or minerals per mile."[1] It is essential to call attention to this point. The plain, blunt statement that the railway companies do not know the proportions of profit or of loss due to each of their three main branches of traffic appears at first simply to be incredible. If we suppose that the dividends on Bank of England Stock had declined from their normal ten per cent. to six, to five, and to four, what manner of questions would be put to the half-yearly courts? What acute investigation would there not be directed to ascertain the cause! And if, on the inquiry of a proprietor as to the respective results of the operations of the issue, the banking, and the discount departments of that important institution, the directors were to reply that the accounts could not be dissected; and that, even if this were done, it would be necessary to conceal the result, for fear of the rivalry of the London and Westminster, and other banks, but that the proprietors might rely on the best exertions being used (although the decline of trade, the depreciation of silver, the fear of war, and other causes over which the directors had no control, had unfortunately reduced the general profits): what would be the condition of the great room? Would there not be found men of high standing ready to point out that the fall of a great city establishment, once proudly called "as good as the bank," would have been impossible had all concerned been aware of the state of that branch of business which was really consuming all, and more than all, the immense legitimate profits of the trade of Messrs. Gurney; and that no establishment, great or small, which carried on different kinds of business without distinct balance-sheets for cash, was safe from peril of insolvency?

It has been brought under the notice of the Board of Trade that the returns which are now published, under their auspices, of railway-traffic are so imperfect that they throw no light on the essential question of the respective loss or gain of the passenger, the goods, and the mineral traffic of railways; and that, as that department exerts a general supervision of railways, and annually reports in detail on the movement of each year, the public may justly expect that the board either should secure the information, or clearly state the fact of their deficient knowledge.

The Board of Trade have replied that in 1840

[1] "The Index to our Railway System," by W. Fleming, p. 15.

an attempt made to procure information of this kind failed; that difficulties in the way of such an effort have not diminished since; and that, in the absence of any complaint from shareholders, they do not think that interference on the part of the Government is called for.

In return, it has been urged that it is reliance on the vigilance of the Board of Trade which has been one main cause of the false security of the shareholders; that it is of vital importance that ignorance on so fundamental a condition of the railway system should be removed; and that it is proper that the public should be made aware that the Board of Trade distinctly repudiates the responsibility which is generally held to belong to that branch of the Government, as to supervision either of the financial results, or of the fair and equitable rate of charges, of the railways of the United Kingdom.

It is satisfactory to be able to add that the Board of Trade, on this rejoinder, have announced their intention to make inquiries as to the statistics of the mineral traffic. In the mean time, it is doubly proved, first by Mr. Fleming, and, secondly, by the official correspondence of the Board of Trade, that the question, "What is the financial result of the mineral traffic of railways?" is at the present moment entirely unanswered.

In the absence of proper balance-sheets on the part of the railway companies, and of proper statistical returns on the part of the Board of Trade, the first inquiry likely to suggest itself to any person earnestly desirous to arrive at the real economical outcome of the mineral traffic on our railways will be, "What information is to be derived from railway accounts in other parts of the world?"

The reply is, that many of the railway companies in America, most of them in France, and all of them in India, supply the information which the English companies refuse to give, and which the Board of Trade fails to obtain. Further, analyses of American, of French, and of Indian accounts throw so much light on the question at issue as to suggest that the reasons for suppressing that information on the English lines, whether they be those alleged or not, are insufficient to justify a mode of proceeding alike opposed to public polity and dangerous to the true interests of the shareholders themselves.

It should be remarked, for the guidance of those persons who may turn for their own satisfaction to the sources of information here indicated, that the results most readily to be obtained require a certain correction, for which, however, most of the materials are supplied. It has been, unfortunately, the practice in the Board of Trade returns to make use of the indefinite unit of a "train-mile" as a means of indicating the results of railway-working. Foreign railway accountants have followed suit in this respect. But the goods and mineral trains weigh from two to four times as much as the passenger-trains, and, therefore, the assumption that they are the same per mile to work is entirely unjustifiable. In the English returns no means whatever are provided for remedying this grave defect. But in the fuller details of the other railway accounts there are to be found, for the most part, by analysis, the means of ascertaining the cost of conveying a definite load for a definite distance. The unit of railway expenditure is the cost of conveying an ascertained weight of train and load for an ascertained distance. The most convenient expression will be that of the ton-mile-gross, or the cost of the conveyance of a ton of train and load (including return of empty wagons and all expenses) for a mile. When this is once known, we begin to ascertain something as to railway cost and railway profit. And when this is accurately known, we shall be on the track of the discovery of that distribution of profitable and unprofitable business which is at present so sedulously concealed.

The total working costs of the railways of the United Kingdom in the year 1875 are stated by the Board of Trade at £33,220,728. The total number of miles traveled by trains in that year is given as 100,731,071 miles by passenger-trains, and 104,635,056 miles by goods and mineral trains. If to this information were added that of the average weights of such trains, we should be able to ascertain the price per ton-mile or per hundred ton-miles-gross. It is the want of the statement of weight that brings us to a standstill.

The total receipt of the railways of the United Kingdom for the same year was £61,237,000. This sum was made up by £25,714,681 receipts for passengers; £13,405,283 receipts for minerals; £19,862,789 receipts for merchandise, including carriage of live-stock; and £2,254,247 from rents, tolls, navigation, and miscellaneous sources.

The numbers of passengers, of tons of goods, and of tons of minerals conveyed are also returned. But we are left in the dark as to either the average fare per passenger, or the average payment per ton for goods or minerals. The corresponding detail of the average distance traveled in a passenger-journey, or the average distance for which a ton of goods or a ton of minerals has

been conveyed, is also omitted. Thus, the mere mileage of trains is a figure without statistical value, as long as it is unknown what the trains in question weigh.

If we refer to the accounts of the French railways which are given in the "Annuaire Officiel," we shall be able to analyze the working expenditure of the lines of the Est, the Midi, the Ouest, the Orléans, and the Lyons Railways. Each of the last two lines consists of a double system; so that, in fact, we have seven independent subjects for comparison. The mean cost of moving 100 tons of gross load on these seven lines, in 1872, was 25.4*d.* In the passenger-trains 5.5 tons of net, or paying load, was carried per 100 tons of loaded train. On the average of goods and mineral trains, 38.5 tons of net, or paying load, was carried for every 100 tons gross load of freight and train.

In the same way, we may take the results of the working of the seven principal Indian railways. These are the East Indian, the Jubbulpore branch of the same line, the Great Indian Peninsula, the Madras, the Bombay, Baroda, Central India, the Punjaub & Delhi, and the Eastern Bengal lines. On these railways the mean cost of conveying 100 tons of gross load for a mile, in 1875, was 26.6*d.* The net, or paying weight, conveyed by the passenger-trains, averaged 11.8 per cent. of the gross load, being more than twice as much in proportion to the dead-weight as on the French lines. For goods and mineral traffic, 100 tons of loaded train contained 32.7 tons of freight.

In America working costs are higher. There has, indeed, been a reduction of as much as 32 per cent. in the cost of working on the Louisville & Great Southern Railway since 1873. In that year the cost of conveying 100 tons of gross load for a mile, averaged over seven sections of line, was 56.4*d.*, or more than double the Indian average. In India, it should be remarked, the cost varied considerably on the different lines, being as low as 17.2*d.* per 100 ton-miles-gross on the East Indian line, and amounting to 35*d.* for the same duty on the Madras Railway. On the French lines the range is not so wide, the cheapest duty performed having been on the *ancien réseau* of the Chemin de Fer d'Orléans, where the cost of moving 100 tons of gross load for a mile was 20*d.*, and the highest being the figure of 37.5*d.* for the same duty, which was the cost on the *nouveau réseau* of the Chemin de Fer de Lyons.

If the proportions of dead-weight to paying load were the same on the French and the English, or on the Indian and the English, railways, it would be a comparatively simple calculation to arrive at the average price per ton-mile-gross of the railway-duty of this country. But the proportion actually existing is very hard to ascertain. No information is published on the subject. In some special cases, where the traffic is of an unusually regular character, as on the Metropolitan and the Taff Vale Railways, it may be possible to approach very closely to the truth in this respect. But for general purposes we must be content to assume a proportion equal to that of the mean of the fourteen railways analyzed, subject to future verification or correction.

The average charges per passenger and per ton of goods are estimated by M. de Franqueville at between 16 and 17 per cent. higher in England than in France. The working expenses, expressed in percentage of gross income, are 11 per cent. higher in the former country than in the latter. If the proportions of net and gross weight are the same, the working cost in England, on these data, will be 27.5 per cent. higher than in France—a proportion which gives the cost of 32.4*d.* per 100 ton-miles-gross as that of the English duty.

If we make a similar comparison with the Indian lines, we find that the goods tariff is about the same as that of the English railways, and that the passenger fares on the Indian are about a third of those on the English lines. The working costs on the seven lines analyzed, in 1875, amounted to 49 per cent. of the gross revenue in India, and to 54.4 per cent. of the gross revenue in the United Kingdom. The gross receipts from the Indian passenger traffic are 32.3 per cent. of the total earnings. The corrections due to these differences amount to an increase of the Indian working cost per ton-mile by nearly 28 per cent. for the English equivalent. This gives a working cost for the latter of 33.9 per 100 ton-miles-gross —a result within 1.5*d.* of that arrived at from comparison of the French lines. It is impossible to come closer to the mark without a correct statement of the tare, or dead-weight, in each case and in each description of traffic. The smaller tare of the Indian lines in the passenger traffic, while the goods tare is less than on the French lines, goes far to account for the difference in the results above stated.

The passenger traffic of the United Kingdom for the year 1875, allowing fifteen passengers to the ton, involved the transport of 34.2 million tons of net weight. We have before remarked that the average length of a passenger journey is

not given. It is estimated by M. de Franqueville at 8.68 miles. If we take this as an approximation, and allow the same tare for the passenger traffic as on the French lines, we arrive at an aggregate of 5,628 millions of ton-miles-gross for the passenger traffic of the railways of the United Kingdom. If we take the tare of the Indian passenger traffic, or if we allow, as on a former occasion, a mean between the French and the Indian tare, we obtain somewhat different results. But, in making use of figures estimated by M. de Franqueville, it is desirable not to introduce any sources of correction or of disturbance with which that careful investigator was unacquainted.

The net tonnage of goods and minerals for the same year was a little over 200,000,000 tons. The average distance over which this weight was conveyed is taken by M. de Franqueville as thirty-six miles. This, at the French rate of fare, would give a total of 18,700 millions of ton-miles-gross for the heavy traffic, making a grand total of 24,328 millions of ton-miles-gross as the duty of our English railways. This amount of duty would make the average cost of conveying 100 tons gross for a mile amount to 32.6*d.*, a result almost identical with that arrived at by comparison with the French railways. It may be remembered that the gross total of ton-mileage arrived at by taking a tare intermediate between that of the French and that of the Indian railways was stated as 25,072 millions of ton-miles, the passenger tare being raised and the mineral tare being reduced, by taking French proportions alone. The difference of result thus obtained, while interesting as showing the limits of variation in practice, shows further the absolute need of obtaining definite returns on these points from the railway companies of the United Kingdom.

On the Taff Vale Railway, which was originally constructed as a mineral line, and on which the passenger traffic only earns 14 per cent. of the gross receipts, the charge for the conveyance of minerals is .78*d.* per ton net per mile. The tare on this line is kept down to the unusually low proportion of 50 per cent., including return of empty wagons. The working expenses amount to 57 per cent. of the gross revenue. If we allow them to reach 60 per cent. for the mineral traffic (which is, of course, the least productive per ton-mile), we find the working cost of conveying 100,000 tons gross for a mile to be 23.4*d.* This figure (which probably is kept somewhat too low by the percentage distribution) is the lowest known to be attained on any English railway.

On the Metropolitan Railway the weight of the trains is a regular quantity. The cost of locomotion and maintenance on this line is considerably increased by the frequent stoppages, and by the rapidity with which a high speed is attained and arrested. The contingent expenses, including rates, are also unusually high. Thus, although the Metropolitan line works at a lower percentage on receipts than any other English railway, the cost of its duty per ton-mile is unusually high. From reliable data this cost has been calculated for 1873 at 45.7*d.* per 100 ton-miles-gross, which is close upon the American cost for the same year of 44.4*d.* It thus appears that the variation in the cost of duty performed on the English railways is about the same as that on the Indian lines; the most expensive instance approaching the double of the cheapest. On the Taff Vale, however, the only two items of charge included in the price quoted are for road-tolls and for locomotive power. There is a charge of 2*d.* per ton for shipping, which is not included in the rates cited, the distribution of which would somewhat raise the price per ton-mile-gross. The wagons are provided, repaired, and loaded by the freighters, and in point of fact the traffic expenses on the Taff Vale line are 3.5 per cent. below the average for the United Kingdom.

On the above data it is safe to assume that the ordinary cost of moving a ton of gross load for a mile on an English railway averages about one-third of a penny, never quite rising, on any important line, to a halfpenny, never falling, all things considered, so low as a farthing. And although this cost is not the direct measure of the profitable character of the traffic, it is a prime element in the calculation of profit. It is a datum for the engineer rather than for the financier. Between line and line the importance of this element is to a great extent controlled by other influences. But as to the cost of the different branches of traffic on any one line, the knowledge of the cost of duty is the first and most important step to be taken.

The absolute exactitude with which the duty cost per ton-mile-gross may be made use of in order to dissect the working cost of the different kinds of traffic on the same line depends on two, and only two, additional conditions. The first is that to which reference has more than once been made—namely, the proportion of tare or dead weight. The knowledge of this is essential in order to know what proportion obtains between the ton-mile-gross, which is the unit of cost, and the ton-mile-net, which is the unit of income.

A further question arises as to whether the

cost of the ton-mile-gross is the same for all descriptions of traffic—that is to say, whether it costs more or less, on the average, to move a ton of mineral-train or a ton of passenger-train. On this question some very unexpected light may be cast by a careful comparative analysis of the returns furnished by the Board of Trade. It is true that exact statements, depending on length of line for which traffic is conveyed, and on amount of tare for each description of traffic, are unattainable without definite information on those two essential points. But, in the absence of the means of direct analysis, it sometimes occurs that results of nearly equal value to those sought in vain by that method may be obtained by comparative analysis. For this (in the present instance) there exist elements of unquestionable value, and it cannot be denied that the figures we have to bring forward are such as to give information of very great importance with respect to the comparative profit of mineral and of passenger traffic on main trunk-lines.

The great trunk-lines of railway which radiate from London vary to an extraordinary degree in the proportion of mineral traffic which they convey. Thus the Southeastern line receives less than 4 per cent. of its gross revenue from mineral conveyance; while the Midland Railway derives 27½ per cent. of its earnings from that source. If fares and freight were so arranged that the mineral traffic should be as remunerative as (or, as many of its supporters urge, more remunerative than) the passenger traffic, the fact would certainly come out from our comparative analysis of the accounts of these lines.

The working cost of railways may be conveniently distributed under the following heads: First come the actual expenses of carriage, including locomotion, maintenance of way and works, and engine and carriage repairs. On the average of the railways of the United Kingdom for 1875 the cost of these items amounted to 30.38 per cent. of the gross revenue. The second main item is known by the name of "traffic-charges," and includes the cost of the service of station-yards, cartage, and generally of the ordinary fixed expenditure, which does not come under the former head. The average percentage of traffic-charges on revenue in the United Kingdom in 1875 was 16.22 per cent. The passenger duty, from which the Irish lines are exempt, should be mentioned as a separate item. For 1875 it amounted to 1.39 per cent. on the English lines, 0.87 per cent. on those of Scotland, and 1.27 per cent. on the average of the United Kingdom. The balance of general charges, rates and taxes, legal expenses, compensation for losses and for personal injuries, and miscellaneous expenses, amounted in the year in question to 6.38 per cent.; making the average proportion of expenditure to receipts, from all sources, 54.25 per cent.

On the Metropolitan Railway, on which the mineral earnings form only 2.3 per cent. of the total revenue, the cost of the first class of expenses in 1875 was 15 per cent. of the gross total. On the Southeastern Railway, with 3.8 per cent. of mineral revenue, the percentage of these items was 21 per cent. On the Great Eastern, with 10 per cent. of mineral revenue, it rises to 25.5 per cent. On the Midland, with 27.5 per cent. of mineral revenue, the percentage of locomotive expenditure (including the three items named) is 29 per cent. Thus, the line which carries 27.5 per cent. of mineral traffic costs more to work than the line which carries 2.3 per cent. of mineral traffic by 14 per cent. of its gross income, the locomotion, maintenance, and repairs on the former line costing half as much again as on the latter, in proportion to gross earnings. And the Northeastern, on which line the mineral income forms 37 per cent. of the whole, actually spends 35.5 per cent. of its gross revenue in this group of expenditure.

It is thus as certain as any statistical fact can be that the increase of mineral traffic on a railway is accompanied by a very sensible increase in the working expenditure of the line. We are not speaking of lines directly constructed for the service of colliery districts, as in the case of the Taff Vale, where a mineral traffic of 61.5 per cent. coincides with a carriage-cost of 29.7 per cent., under exceptionally favorable circumstances. The subject we have under investigation is the cost of mixed traffic on trunk-lines of railway, laid down for passenger traffic. On these we find that, for every additional one per cent. of mineral traffic borne by the line, the charges for locomotion, maintenance, and repairs, are increased on the average by more than one-half per cent. of the entire revenue. Owing to the increase of these three items alone, therefore, only about half of the nominal gross in-take from minerals has to be credited to revenue.

It has been urged by a very able and energetic advocate of mineral traffic on railways that the saving in "traffic expenses" accompanying that branch of trade is so great as to make the business very profitable to the companies. Comparative analysis, however, does not support this assertion. On the Metropolitan Railway, in spite

of the cost of the special omnibus service, the percentage of traffic expenses is only 13.75 on the gross revenue, or 2.47 below the average for the United Kingdom. On the Southeastern line, the percentage is 14.09; on the Brighton, 13.67; but on the Midland it rises to 18.16, or 1.94 per cent. above the average for the United Kingdom. Thus, to say that this item of railway cost is diminished by increasing the proportion of mineral traffic is simply to state what is contrary to published facts.

The incidence of the Government duty is of course proportionately heavier, the smaller the amount of mineral traffic. This is, however, a burden that may be borne without reluctance by those who study the figures above stated. As to the remaining items of expenditure, any variation in their incidence depends very much on local conditions, and can only be directly connected with the question of the proportion of mineral traffic by the amount of the payments for compensation. These do not, however, materially affect the question; as the average incidence for the United Kingdom is less than half per cent. on the gross returns.

It is thus absolutely undeniable that, while the circulation of heavy mineral trains on a main trunk-line of railway increases the cost of locomotive power, of maintenance, and of repairs, so rapidly as to leave only half of the sum nominally received for mineral freight available for the payment of all other expenses, including dividend, incurred in the conduct of such traffic, there is no saving, but rather an extra expense, in the "traffic-charges," and no appreciable diminution in other items of outlay which can be credited to the mineral traffic.

From the above facts it is manifest that, of the £13,400,000 received by the railway companies of the United Kingdom in 1875, so considerable a portion is counterbalanced by the augmentation in the expenditure caused by the conduct of a mixed traffic, that the possible source of profit to the shareholders is reduced to an almost imperceptible figure. The investigation previously carried out as to the cost of duty per ton-mile-gross is fully adequate to explain this fact.

The mineral traffic of the metropolis, as a rule, all goes in one direction. The vehicles bearing coals are sent up full, and have to be taken back empty, at the cost of the carrying companies, which thus receive only one payment for two duties. The exact amount of tare is, as we have seen, one of those points in which the Board of Trade returns are defective, and in which foreign railway companies give information refused by those of the United Kingdom. We have said that, under exceptionally favorable circumstances, the amount of mineral tare has been kept down to 50 per cent. of the gross load. Considering that the average tare of merchandise and mineral trains on the French lines investigated is 61.5 per cent., and on the Indian lines 67.3 per cent., and that much merchandise goes in both directions, while mineral traffic (except in the cross-lines, which may exchange coals for ironstone) goes mainly in one, it will probably be much understating the tare of the mineral trains to take it at 64 per cent. of the gross load, being the mean between the French and the Indian proportion of dead-weight.

On this allowance, 100 tons of loaded mineral train (taking returns into account) will carry 36 tons of minerals. The average cost of the duty will be 33.3*d.* for a mile of lead, that is to say, of distance for which the freight is carried. This is equivalent to a cost of .925*d.* per ton of mineral conveyed. This figure, which is an approximate cost price, is more than the freight usually charged. On the Taff Vale, for haulage and tolls alone, the charge is .78*d.* per ton of coal per mile. On the Midland, freight is stated recently to have been reduced to .55*d.*, and on the Great Northern to .45*d.*, per ton per mile. We have before seen that the working cost of the two items covered by the Taff Vale charge approximately amounts to 23.4 per 100 ton-miles-gross. Even that exceptionally low rate comes to the cost of .65*d.* per ton of coal per mile, at a tare allowance of 64 per cent. The saving of the Taff Vale in traffic expenses, as compared to the Midland rate, amounts to .05*d.* per ton of coal per mile. That good examples of *bona-fide* profit from purely mineral lines occur is not disputed. But that any profit whatever is gained by the conveyance of coals to London at prices below .7*d.* per ton of coal per mile is a statement altogether contradicted by the statistics now before us.

A moderate profit per ton, however, even if earned, would still be far from compensatory to main trunk-lines for undertaking the conveyance of minerals. It is a truism to say that such traffic is a losing speculation unless its net results be such as to pay interest on the capital invested in order to carry it out. The question here is to ascertain how much of the £38,000 per mile which our railways have now cost has been expended in order to provide for the mineral

traffic. We see some main lines already doubling their tracks expressly to give accommodation to the slow trains. The ordinary mercantile rule would be to charge the capital in proportion to the work done, or to the occupation of the railway by each class of traffic. If this mode of apportionment of capital were adopted, it would debit the mineral traffic with interest on more than half the total capital invested in our railways. But, even if revenue be taken as the basis of account, 22.5 per cent. of the total capital outlay must look to the mineral traffic to provide the interest on its expenditure. This proportion gives a total of £141,750,000 expended in providing for the conveyance of the mineral traffic on railways. To pay 4¼ per cent. on this sum requires a net profit of £6,024,375 per annum; and any profit short of that amount derived from the mineral traffic is *pro tanto* a depreciation of the general dividend actually paid. That is to say, that on the most moderate distribution of capital outlay, or rather on that distribution which is most unjustly favorable to the mineral traffic, a profit of 45 per cent. of the net earnings is requisite in order to avoid a deterioration of the general dividend as the result of this branch of business. For the shareholders not to be actually out of pocket by the mineral traffic, this branch of the trade must earn a net profit of £6,000,000 per annum. The gross revenue, however, from this source is only £13,400,000. To earn this, according to the statistics above given, the general expenses of the company have been increased by between £6,000,000 and £7,000,000 per annum. If we compare the charge per ton for conveyance with the cost of conveyance, we find that it is only in very favorable cases that there is any margin whatever for profit in mineral transport. Certain rates, lately adopted in order to compete with sea-carriage, involve palpable loss.

It seems very difficult to escape from the conclusion that the efforts made by the railway companies to deprive the canals of their proper traffic have in the first place been the main cause of the heavy and annually increasing list of killed and wounded on railways, especially among the servants of the companies; and, in the second place, have effected a reduction of the average dividends paid on the railways of the United Kingdom by something like a fourth part of their amount. So that it is not extravagant to suggest that the maintenance of this traffic by the railway companies costs the country at least five thousand casualities every year—of which nearly one-fourth are fatal—and costs the railway companies at least £5,000,000 per annum. The figures are startling; but they are not imaginary.

It is only just to the reader to add that the above statements are the unbiased outcome of statistical investigation. They are prompted by no interest except that of the public welfare. They are not the sequence of any preconceived idea, or the result of any personal hobby. A certain want of precision, as has always been allowed, characterizes every attempt at the direct analysis of the profits of the English railways. That want of precision is due to the concealment by the English companies of a class of facts which are published by American, by French, and by Indian railway managers. The results obtained from these more complete returns are such as to show that ignorance of the facts concealed is contrary to public welfare, and is likely to be extremely dangerous to the proprietors of railway capital. The more incertitude there is on this part of the subject, the louder and more imperative is the demand for full information. On the other hand, the comparative analysis, now for the first time attempted, has results as to the bearing of which there can be no question. It is not a matter of opinion that the working cost of railways of mixed traffic increases with the proportion of mineral traffic. For the sake of conciseness, only two or three lines have been analyzed in the foregoing pages, but the same analysis has actually been applied to the returns of all the principal trunk-lines. On each of these some special features may be pointed out, but on all the general rule is clearly exemplified. The fact that minerals can be conveyed on lines laid out and well adapted for the service of a mineral district, at remunerative prices, has probably been the basis on which the whole doctrine of the value of mineral traffic on mixed lines, which is quite another question, is founded. It might have been sufficient to point out the difference between a case of this kind and one in which there is a competition with a sea-borne traffic, to show that the profit earned by such a line as the Taff Vale can have but little to do with the profit at which minerals can be conveyed by the London & Northwestern, or any other great trunk-line fully occupied by light and rapid traffic. As to this, the comparison of the proportion of mineral earnings and of locomotive charges gives a positive indication which it will be madness on the part of the shareholders to neglect. All human investigations are liable to error, and there

is good reason to subject these now brought forward to the most searching check. But no objection, at all events to the comparative part of the foregoing analysis, can have any serious value which is not founded on the statement of definite facts—that is to say, on the publication by the railways of the United Kingdom of those statistics of their annual working which are given to the shareholders of American, French, and Indian lines. In the absence of this information, no shareholder can be aware whether his property is likely to improve to the value of some of the former, or to deteriorate to the negative condition of the Belgian railways, or of the American colliery lines.

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THE ETHICS OF RELIGION.

By Professor W. KINGDON CLIFFORD, F.R.S.

THE word *religion* is used in many different meanings, and there have been not a few controversies in which the main difference between the contending parties was only this, that they understood by *religion* two different things. I will therefore begin by setting forth as clearly as I can one or two of the meanings which the word appears to have in popular speech.

First, then, it may mean a body of doctrines, as in the common phrase, "The truth of the Christian religion;" or in this sentence, "The religion of Buddha teaches that the soul is not a distinct substance." Opinions differ upon the question what doctrines may properly be called religious; some people holding that there can be no religion without belief in a god and in a future life, so that, in their judgment, the body of doctrines must necessarily include these two; while others would insist upon other special dogmas being included, before they could consent to call the system by this name. But the number of such people is daily diminishing, by reason of the spread and the increase of our knowledge about distant countries and races. To me, indeed, it would seem rash to assert of any doctrine or its contrary that it might not form part of a religion. But, fortunately, it is not necessary to any part of the discussion on which I propose to enter, that this question should be settled.

Secondly, religion may mean a *ceremonial* or *cult*, involving an organized priesthood and a machinery of sacred things and places. In this sense we speak of the clergy as ministers of religion, or of a state as tolerating the practice of certain religions. There is a somewhat wider meaning which it will be convenient to consider together with this one, and as a mere extension of it, namely, that in which religion stands for the influence of a certain priesthood. A religion is sometimes said to have been successful when it has got its priests into power; thus some writers speak of the wonderfully rapid success of Christianity. A nation is said to have embraced a religion when the authorities of that nation have granted privileges to the clergy, have made them as far as possible the leaders of society, and have given them a considerable share in the management of public affairs. So the northern nations of Europe are said to have embraced the Catholic religion at an early date. The reason why it seems to me convenient to take these two meanings together is, that they are both related to the priesthood. Although the priesthood itself is not called religion, so far as I know, yet the word is used for the general influence and the professional acts of the priesthood.

Thirdly, religion may mean a body of precepts or code of rules, intended to guide human conduct, as in this sentence of the authorized version of the New Testament: "Pure religion and undefiled before God and the Father is this, to visit the fatherless and widows in their affliction, and to keep himself unspotted from the world" (James i. 27). It is sometimes difficult to draw the line between this meaning and the last, for it is a mark of the great majority of religions that they confound ceremonial observances with duties having real moral obligation. Thus in the Jewish decalogue the command to do no work on Saturdays is found side by side with the prohibition of murder and theft. It might seem to be the more correct as well as the more philosophical course to follow in this matter the distinction made by Butler between *moral* and *positive* commands, and to class all those precepts which are not of universal moral obligation under the head of ceremonial. And, in fact, when we come to examine the matter from the point

of view of morality, the distinction is of course of the utmost importance. But from the point of view of religion there are difficulties in making it. In the first place, the distinction is not made, or is not understood, by religious folk in general. Innumerable tracts and pretty stories impress upon us that Sabbath-breaking is rather worse than stealing, and leads naturally on to materialism and murder. Less than a hundred years ago sacrilege was punishable by burning in France, and murder by simple decapitation. In the next place, if we pick out a religion at haphazard, we shall find that it is not at all easy to divide its precepts into those which are really of moral obligation and those which are indifferent and of a ceremonial character. We may find precepts unconnected with any ceremonial, and yet positively immoral; and ceremonials may be immoral in themselves, or constructively immoral, on account of their known symbolism. On the whole, it seems to me most convenient to draw the plain and obvious distinction between those actions which a religion prescribes to *all* its followers, whether the actions are ceremonial or not, and those which are prescribed only as professional actions of a sacerdotal class. The latter will come under what I have called the second meaning of religion, the professional acts and the influence of a priesthood. In the third meaning will be included all that practically guides the life of a layman, in so far as this guidance is supplied to him by his religion.

Fourthly, and lastly, there is a meaning of the word *religion* which has been coming more and more prominently forward of late years, till it has even threatened to supersede all the others. Religion has been defined as *morality touched with emotion.* I will not here adopt this definition, because I wish to deal with the concrete in the first place, and only to pass on to the abstract in so far as that previous study appears to lead to it. I wish to consider the facts of religion as we find them, and not ideal possibilities. "Yes, but," every one will say, "if you mean my own religion, it is already, as a matter of fact, morality touched with emotion. It is the highest morality touched with the purest emotion, an emotion directed toward the most worthy of objects." Unfortunately we do not mean your religion alone, but all manner of heresies and heathenisms along with it: the religions of the Thug, of the Jesuit, of the South-Sea cannibal, of Confucius, of the poor Indian with his untutored mind, of the Peculiar People, of the Mormons, and of the old cat-worshiping Egyptian. It must be clear that we shall restrict ourselves to a very narrow circle of what are commonly called religious facts, unless we include in our considerations not only morality touched with emotion, but also immorality touched with emotion. In fact, what is really touched with emotion in any case is that body of precepts for the guidance of a layman's life which we have taken to be the third meaning of religion. In that collection of precepts there may be some agreeable to morality, and some repugnant to it, and some indifferent, but being all enjoined by the religion they will all be touched by the same religious emotion. Shall we then say that religion means a feeling, an emotion, an habitual attitude of mind toward some object or objects, or toward life in general, which has a bearing upon the way in which men regard the rules of conduct? I think the last phrase should be left out. An habitual attitude of mind, of a religious character, does always have some bearing upon the way in which men regard the rules of conduct; but it seems sometimes as if this were an accident, and not the essence of the religious feeling. Some devout people prefer to have their devotion pure and simple, without admixture of any such application—they do not want to listen to "cauld morality." And it seems as if the religious feeling of the Greeks, and partly also of our own ancestors, was so far divorced from morality that it affected it only, as it were, by a side-wind, through the influence of the character and example of the gods. So that it seems only likely to create confusion if we mix up morality with this fourth meaning of religion. Sometimes religion means a code of precepts, and sometimes it means a devotional habit of mind; the two things are sometimes connected, but also they are sometimes quite distinct. But that the connection of these two things is more and more insisted on, that it is the key-note of the apparent revival of religion which has taken place in this century, is a very significant fact, about which there is more to be said.

As to the nature of this devotional habit of mind, there are no doubt many who would like a closer definition. But I am not at all prepared to say what attitude of mind may properly be called religious, and what may not. Some will hold that religion must have a person for its object; but Buddha was filled with religious feeling, and yet he had no personal object. Spinoza, the god-intoxicated man, had no personal object for his devotion. It might be possible to frame a definition which would fairly include all cases,

but it would require the expenditure of vast ingenuity and research, and would not, I am inclined to think, be of much use when it was obtained.

Nor is the difficulty to be got over by taking any definite and well-organized sect, whose principles are settled in black and white; for example, the Roman Catholic Church, whose seamless unity has just been exhibited and protected by an Œcumenical Council. Shall we listen to Mr. Mivart, who "execrates without reserve Marian persecutions, the massacre of St. Bartholomew, and all similar acts?" or to the editor of the *Dublin Review*, who thinks that a teacher of false doctrines "should be visited by the law with just that amount of severity which the public sentiment will bear?" For assuredly common-sense morality will pass very different judgments on these two distinct religions, although it appears that experts have found room for both of them within the limits of the Vatican definitions.

Moreover, there is very great good to be got by widening our view of what may be contained in religion. If we go to a man and propose to test his own religion by the canons of common-sense morality, he will be, most likely, offended, for he will say that his religion is far too sublime and exalted to be affected by considerations of that sort. But he will have no such objection in the case of other people's religion. And when he has found that in the name of religion other people, in other circumstances, have believed in doctrines that were false, have supported priesthoods that were social evils, have taken wrong for right, and have even poisoned the very sources of morality, he may be tempted to ask himself, "Is there no trace of any of these evils in my own religion, or at least in my own conception and practice of it?" And that is just what we want him to do. Bring your doctrines, your priesthoods, your precepts, yea, even the inner devotion of your soul, before the tribunal of conscience; she is no man's and no god's vicar, but the supreme judge of men and gods.

Let us inquire, then, what morality has to say in regard to religious doctrines. It deals with the *manner* of religious belief directly, and with the *matter* indirectly. Religious beliefs must be founded on evidence; if they are not so founded, it is wrong to hold them. The rule of right conduct in this matter is exactly the opposite of that implied in the two famous texts, "He that believeth not shall be damned," and "Blessed are they that have not seen and yet have believed." For a man who clearly felt and recognized the duty of intellectual honesty, of carefully testing every belief before he received it, and especially before he recommended it to others, it would be impossible to ascribe the profoundly immoral teaching of these texts to a true prophet or worthy leader of humanity. It will comfort those who wish to preserve their reverence for the character of a great teacher to remember that one of these sayings is in the well-known forged passage at the end of the second gospel, and that the other occurs only in the late and legendary fourth gospel; both being described as spoken under utterly impossible circumstances. These precepts belong to the Church and not to the gospel. But whoever wrote either of them down as a deliverance of one whom he supposed to be a divine teacher, has thereby written down himself as a man void of intellectual honesty, as a man whose word cannot be trusted, as a man who would accept and spread about any kind of baseless fiction for fear of believing too little.

So far as to the manner of religious belief. Let us now inquire what bearing morality has upon its matter. We may see at once that this can only be indirect; for the rightness or wrongness of belief in a doctrine depends only upon the nature of the evidence for it, and not upon what the doctrine is. But there is a very important way in which religious doctrine may lead to morality or immorality, and in which, therefore, morality has a bearing upon doctrine. It is when that doctrine declares the character and actions of the gods who are regarded as objects of reverence and worship. If a god is represented as doing that which is clearly wrong, and is still held up to the reverence of men, they will be tempted to think that in doing this wrong thing they are not so very wrong after all, but are only following an example which all men respect. So says Plato:[1]

"We must not tell a youthful listener that he will be doing nothing extraordinary if he commit the foulest crimes, nor yet if he chastise the crimes of a father in the most unscrupulous manner, but will simply be doing what the first and greatest of the gods have done before him. . . .

"Nor yet is it proper to say in any case—what is indeed untrue—that gods wage war against gods, and intrigue and fight among themselves; that is, if the future guardians of our state are to deem it a most disgraceful thing to quarrel lightly with one another: far less ought we to select as subjects for fiction and embroidery the battles of the giants, and numerous other feuds of all sorts, in which

[1] "Rep." ii., 378; translation of Davies and Vaughan.

gods and heroes fight against their own kith and kin. But if there is any possibility of persuading them that to quarrel with one's fellow is a sin, of which no member of a state was ever guilty, such ought rather to be the language held to our children from the first, by old men and old women, and all elderly persons; and such is the strain in which our poets must be compelled to write. But stories like the chaining of Hera by her son, and the flinging of Hephaistos out of heaven for trying to take his mother's part when his father was beating her, and all those battles of the gods which are to be found in Homer, must be refused admittance into our state, whether they be allegorical or not. For a child cannot discriminate between what is allegory and what is not; and whatever at that age is adopted as a matter of belief, has a tendency to become fixed and indelible, and therefore, perhaps, we ought to esteem it of the greatest importance that the fictions which children first hear should be adapted in the most perfect manner to the promotion of virtue."

And Seneca says the same thing, with still more reason in his day and country: "What else is this appeal to the precedent of the gods for, but to inflame our lusts, and to furnish license and excuse for the corrupt act under the divine protection?" And again, of the character of Jupiter as described in the popular legends: "This has led to no other result than to deprive sin of its shame in man's eyes, by showing him the god no better than himself." In imperial Rome, the sink of all nations, it was not uncommon to find "the intending sinner addressing to the deified vice which he contemplated a prayer for the success of his design; the adulteress imploring of Venus the favors of her paramour; . . . the thief praying to Hermes Dolios for aid in his enterprise, or offering up to him the first-fruits of his plunder; . . . youths entreating Hercules to expedite the death of a rich uncle."[1]

When we reflect that criminal deities were worshiped all over the empire, we cannot but wonder that any good people were left; that man could still be holy, although every god was vile. Yet this was undoubtedly the case; the social forces worked steadily on wherever there were peace and a settled government and municipal freedom; and the wicked stories of theologians were somehow explained away and disregarded. If men were no better than their religions, the world would be a hell indeed.

It is very important, however, to consider what really ought to be done in the case of stories like these. When the poet sings that Zeus kicked Hephaistos out of heaven for trying to help his mother, Plato says that this fiction must be suppressed by law. We cannot follow him there, for since his time we have had too much of trying to suppress false doctrines by law. Plato thinks it quite obviously clear that God cannot produce evil, and he would stop everybody's mouth who ventured to say that he can. But in regard to the doctrine itself, we can only ask, "Is it true?" And that is a question to be settled by evidence. Did Zeus commit this crime, or did he not? We must ask the apologists, the reconcilers of religion and science, what evidence they can produce to prove that Zeus kicked Hephaistos out of heaven. That a doctrine may lead to immoral consequences is no reason for disbelieving it. But whether the doctrine were true or false, one thing does clearly follow from its moral character: namely, this, that if Zeus behaved as he is said to have behaved, he ought not to be worshiped. To those who complain of his violence and injustice, it is no answer to say that the divine attributes are far above human comprehension — that the ways of Zeus are not our ways, neither are his thoughts our thoughts. If he is to be worshiped, he must do something vaster and nobler and greater than good men do, but it must be like what they do in its goodness. His actions must not be merely a magnified copy of what bad men do. So soon as they are thus represented, morality has something to say. Not indeed about the fact; for it is not conscience, but reason, that has to judge matters of fact; but about the worship of a character so represented. If there really is good evidence that Zeus kicked Hephaistos out of heaven, and seduced Alkmene by a mean trick, say so by all means; but say, also, that it is wrong to salute his priests or to make offerings in his temple.

When men do their duty in this respect, morality has a very curious indirect effect on the religious doctrine itself. As soon as the offerings become less frequent, the evidence for the doctrine begins to fade away; the process of theological interpretation gradually brings out the true inner meaning of it, that Zeus did not kick Hephaistos out of heaven, and did not seduce Alkmene.

Is this a merely theoretical discussion about far-away things? Let us come back for a moment to our own time and country, and think whether there can be any lesson for us in this refusal of common-sense morality to worship a deity whose actions are a magnified copy of what bad men do. There are three doctrines which

[1] *North British Review*, 1867, p. 284.

find very wide acceptance among our countrymen at the present day: the doctrines of original sin, of a vicarious sacrifice, and of eternal punishments. We are not concerned with any refined evaporations of these doctrines which are exhaled by courtly theologians, but with the naked statements which are put into the minds of children and of ignorant people, which are taught broadcast and without shame in denominational schools. Father Faber, good soul, persuaded himself that after all only a very few people would be really damned, and Father Oxenham gives one the impression that it will not hurt even them very much. But one learns the practical teaching of the Church from such books as "A Glimpse of Hell," where a child is described as thrown between the bars upon the burning coals, there to writhe forever. The masses do not get the elegant emasculations of Father Faber and Father Oxenham; they get "a Glimpse of Hell."

Now, to condemn all mankind for the sin of Adam and Eve; to let the innocent suffer for the guilty; to keep any one alive in torture for ever and ever: these actions are simply magnified copies of what bad men do. No juggling with "divine justice and mercy" can make them anything else. This must be said to all kinds and conditions of men: that if God holds all mankind guilty for the sin of Adam, if he has visited upon the innocent the punishment of the guilty, if he is to torture any single soul forever, then it is wrong to worship him.

But there is something to be said, also, to those who think that religious beliefs are not indeed true, but are useful for the masses; who deprecate any open and public argument against them, and think that all skeptical books should be published at a high price; who go to church, not because they approve of it themselves, but to set an example to the servants. Let us ask them to ponder the words of Plato, who, like them, thought that all these tales of the gods were fables, but still fables which might be useful to amuse children with: "*We ought to esteem it of the greatest importance that the fictions which children first hear should be adapted in the most perfect manner to the promotion of virtue.*" If we grant to you that it is good for poor people and children to believe some of these fictions, is it not better, at least, that they should believe those which are adapted to the promotion of virtue? Now, the stories which you send your servants and children to hear are adapted to the promotion of vice. So far as the remedy is in your own hands, you are bound to apply it; stop your voluntary subscriptions and the moral support of your presence from any place where the criminal doctrines are taught. You will find more men and better men to preach that which is agreeable to their conscience, than to thunder out doctrines under which their minds are always uneasy, and which only a continual self-deception can keep them from feeling to be wicked.

Let us now go on to inquire what morality has to say in the matter of religious *ministrations*, the official acts and the general influence of a priesthood. This question seems to me a more difficult one than the former; at any rate it is not so easy to find general principles which are at once simple in their nature and clear to the conscience of any man who honestly considers them. One such principle, indeed, there is, which can hardly be stated in a Protestant country without meeting with a cordial response; being indeed that characteristic of our race which made the Reformation a necessity, and became the soul of the Protestant movement. I mean the principle which forbids the priest to come between a man and his conscience. If it be true, as our daily experience teaches us, that the moral sense gains in clearness and power by exercise, by the constant endeavor to find out and to see for ourselves what is right and what is wrong, it must be nothing short of a moral suicide to delegate our conscience to another man. It is true that when we are in difficulties, and do not altogether see our way, we quite rightly seek counsel and advice of some friend who has more experience, more wisdom begot by it, more devotion to the right, than ourselves, and who, not being involved in the difficulties which encompass us, may more easily see the way out of them. But such counsel does not and ought not to take the place of our private judgment; on the contrary, among wise men it is asked and given for the purpose of helping and supporting private judgment. I should go to my friend, not that he may tell me what to do, but that he may help me to see what is right.

Now, as we all know, there is a priesthood whose influence is not to be made light of, even in our own land, which claims to do two things: to declare with infallible authority what is right and what is wrong, and to take away the guilt of the sinner after confession has been made to it. The second of these claims we shall come back upon in connection with another part of the subject. But that claim is one which, as it seems to me, ought to condemn the priesthood making it in the eyes of every conscientious

man. We must take care to keep this question to itself, and not to let it be confused with quite different ones. The priesthood in question, as we all know, has taught that as right which is not right, and has condemned as wrong some of the holiest duties of mankind. But this is not what we are here concerned with. Let us put an ideal case of a priesthood which, as a matter of fact, taught a morality agreeing with the healthy conscience of all men at a given time; but which, nevertheless, taught this as an infallible revelation. The tendency of such teaching, if really accepted, would be to destroy morality altogether, for it is of the very essence of the moral sense that it is a common perception by men of what is good for man. It arises, not in one man's mind by a flash of genius or a transport of ecstasy, but in all men's minds, as the fruit of their necessary intercourse and united labor for a common object. When an infallible authority is set up, the voice of this natural human conscience must be hushed and schooled, and made to speak the words of a formula. Obedience becomes the whole duty of man; and the notion of right is attached to a lifeless code of rules, instead of being the informing character of a nation. The natural consequence is, that it fades gradually out and ends by disappearing altogether. I am not describing a purely conjectural state of things, but an effect which has actually been produced at various times and in considerable populations by the influence of the Catholic Church. It is true that we cannot find an actually crucial instance of a pure morality taught as an infallible revelation, and so in time ceasing to be morality for that reason alone. There are two circumstances which prevent this. One is, that the Catholic priesthood has always practically taught an imperfect morality, and that it is difficult to distinguish between the effects of precepts which are wrong in themselves and precepts which are only wrong because of the manner in which they are enforced. The other circumstance is, that the priesthood has very rarely found a population willing to place itself completely and absolutely under priestly control. Men must live together and work for common objects even in priestridden countries; and those conditions, which in the course of ages have been able to create the moral sense, cannot fail in some degree to recall it to men's minds and gradually to reënforce it. Thus it comes about that a great and increasing portion of life breaks free from priestly influences, and is governed upon right and rational grounds. The goodness of men shows itself in time more powerful than the wickedness of some of their religions.

The practical inference is, then, that we ought to do all in our power to restrain and diminish the influence of any priesthood which claims to rule consciences. But when we attempt to go beyond this plain Protestant principle, we find that the question is one of history and politics. The question which we want to ask ourselves—"Is it right to support this or that priesthood?"—can only be answered by this other question, "What has it done or got done?"

In asking this question, we must bear in mind that the word *priesthood*, as we have used it hitherto, has a very wide meaning—namely, it means any body of men who perform special ceremonies in the name of religion; a *ceremony* being an act which is prescribed by religion to that body of men, but not on account of its intrinsic rightness or wrongness. It includes, therefore, not only the priests of Catholicism, or of the Obi rites, who lay claim to a magical character and powers, but the more familiar clergymen or ministers of Protestant denominations, and the members of monastic orders. But there is a considerable difference, pointed out by Hume, between a priest, who lays claim to a magical character and powers, and a clergyman, in the English sense, as it was understood in Hume's day, whose office was to remind people of their duties every Sunday, and to represent a certain standard of culture in remote country districts. It will, perhaps, conduce to clearness if we use the word *priest* exclusively in the first sense.

There is another confusion which we must endeavor to avoid, if we would really get at the truth of this matter. When one ventures to doubt whether the Catholic clergy has really been an unmixed blessing to Europe, one is generally met by the reply, "You cannot find any fault with the Sermon on the Mount." Now, it would be too much to say that this has nothing to do with the question we were proposing to ask, for there is a sense in which the Sermon on the Mount and the Catholic clergy have something to do with each other. The Sermon on the Mount is admitted on all hands to be the best and most precious thing that Christianity has offered to the world; and it cannot be doubted that the Catholic clergy of East and West were the only spokesmen of Christianity until the Reformation, and are the spokesmen of the vast majority of Christians at this moment. But it must surely

be unnecessary to say, in a Protestant country, that the Catholic Church and the gospel are two very different things. The moral teaching of Christ, as partly preserved in the first three gospels, or—which is the same thing—the moral teaching of the great Rabbi Hillel, as partly preserved in the Pirkè Aboth, is the expression of the conscience of a people who had fought long and heroically for their national existence. In that terrible conflict they had learned the supreme and overwhelming importance of conduct, the necessity for those who would survive, of fighting manfully for their lives and making a stand against the hostile powers around; the weakness and uselessness of solitary and selfish efforts, the necessity for a man who would be a man to lose his poor single personality in the being of a greater and nobler combatant—the nation. And they said all this, after their fashion of short and potent sayings, perhaps better than any other men have said it before or since. "If I am not for myself," said the great Hillel, "who is for me? And if I am only for myself, where is the use of me? *And if not now, when?*" It would be hard to find a more striking contrast than exists between the sturdy unselfish independence of this saying, and the abject and selfish servility of the priestridden claimant of the skies. It was this heroic people that produced the morality of the Sermon on the Mount. But it was not they who produced the priests and the dogmas of Catholicism. Shaven crowns, linen vestments, and the claim to priestly rule over consciences, these were dwellers on the banks of the Nile. The gospel, indeed, came out of Judea, but the Church and her dogmas came out of Egypt. Not, as it is written, "Out of Egypt have I called my son," but, "Out of Egypt have I called my daughter." St. Gregory of Nazianzus remarks with wonder that Egypt, having so lately worshiped bulls, goats, and crocodiles, was now teaching the world the worship of the Trinity in its truest form.[1] Poor, simple St. Gregory! it was not that Egypt had risen higher, but that the world had sunk lower. The empire, which in the time of Augustus had dreaded, and with reason, the corrupting influence of Egyptian superstitions, was now eaten up by them, and rapidly rotting away.

Then, when we ask what has been the influence of the Catholic clergy upon European nations, we are not inquiring about the results of accepting the morality of the Sermon on the Mount; we are inquiring into the effect of attaching an Egyptian priesthood, which teaches Egyptian dogmas, to the life and sayings of a Jewish prophet.

In this inquiry, which requires the knowledge of facts beyond our own immediate experience, we must make use of the great principle of authority, which enables us to profit by the experience of other men. The great civilized countries on the Continent of Europe at the present day—France, Germany, Austria, and Italy—have had an extensive experience of the Catholic clergy for a great number of centuries, and they are forced by strong practical reasons to form a judgment upon the character and tendencies of an institution which is sufficiently powerful to command the attention of all who are interested in public affairs. We might add the experience of our forefathers three centuries ago, and of Ireland at this moment; but home politics are apt to be looked upon with other eyes than those of reason. Let us hear, then, the judgment of the civilized people of Europe on this question.

It is a matter of notoriety that an aider and abettor of clerical pretensions is regarded in France as an enemy of France and of Frenchmen; in Germany, as an enemy of Germany and of Germans; in Austria, as an enemy of Austria and Hungary, of both Austrians and Magyars; and in Italy, as an enemy of Italy and the Italians. He is so regarded, not by a few wild and revolutionary enthusiasts who have cast away all the beliefs of their childhood and all bonds connecting them with the past, but by a great and increasing majority of sober and conscientious men of all creeds and persuasions, who are filled with a love for their country, and whose hopes and aims for the future are animated and guided by the examples of those who have gone before them, and by a sense of the continuity of national life. The profound conviction and determination of the people in all these countries, that the clergy must be restricted to a purely ceremonial province, and must not be allowed to interfere, as clergy, in public affairs—this conviction and determination, I say, are not the effect of a rejection of the Catholic dogmas. Such rejection has not, in fact, been made in Catholic countries by the great majority. It involves many difficult speculative questions, the profound disturbance of old habits of thought, and the toilsome consideration of abstract ideas. But such is the happy inconsistency of human nature, that men who would be shocked and pained by a doubt about the central doctrines of their reli-

[1] *See* Sharpe, "Egyptian Mythology and Egyptian Christianity," p. 114.

gions are far more really and practically shocked and pained by the moral consequences of clerical ascendency. About the dogmas they do not know; they were taught them in childhood, and have not inquired into them since, and therefore they are not competent witnesses to the truth of them. But about the priesthood they do know, by daily and hourly experience; and to its character they are competent witnesses. No man can express his convictions more forcibly than by acting upon them in a great and solemn matter of national importance. In all these countries the conviction of the serious and sober majority of the people is embodied, and is being daily embodied, in special legislation, openly and avowedly intended to guard against clerical aggression. The more closely the Legislature of these countries reflects the popular will, the more clear and pronounced does this tendency become. It may be thwarted or evaded for the moment by constitutional devices and parliamentary tricks, but sooner or later the nation will be thoroughly represented in all of them; and as to what is then to be expected let the panic of the clerical parties make answer.

This is a state of opinion and of feeling which we in our own country find it hard to understand, although it is one of the most persistent characters of our nation in past times. We have spoken so plainly and struck so hard in the past, that we seem to have won the right to let this matter alone. We think our enemies are dead, and we forget that our neighbor's enemies are plainly alive: and then we wonder that he does not sit down, and be quiet as we are. We are not much accustomed to be afraid, and we never know when we are beaten. But those who are nearer to the danger feel a very real and, it seems to me, well-grounded fear. The whole structure of modern society, the fruit of long and painful efforts, the hopes of further improvement, the triumphs of justice, of freedom, and of light, the bonds of patriotism which make each nation one, the bonds of humanity which bring different nations together—all these they see to be menaced with a great and real and even pressing danger. For myself I confess that I cannot help feeling as they feel. It seems to me quite possible that the moral and intellectual culture of Europe, the light and the right, what makes life worth having and men worthy to have it, may be clean swept away by a revival of superstition. We are, perhaps, ourselves not free from such a domestic danger; but no one can doubt that the danger would speedily arise if all Europe at our side should become again barbaric, not with the weakness and docility of a barbarism which has never known better, but with the strength of a past civilization perverted to the service of evil.

Those who know best, then, about the Catholic priesthood at present, regard it as a standing menace to the state and to the moral fabric of society.

Some would have us believe that this condition of things is quite new, and has in fact been created by the Vatican Council. In the middle ages, they say, the Church did incalculable service; or even if you do not allow that, yet the ancient Egyptian priesthood invented many useful arts; or if you have read anything which is not to their credit, there were the Babylonians and Assyrians who had priests, thousands of years ago; and, in fact, the more you go back into prehistoric ages, and the farther you go away into distant countries, the less you can find to say against the priesthoods of those times and places. This statement, for which there is certainly much foundation, may be put into another form: the more you come forward into modern times and neighboring countries, where the facts can actually be got at, the more complete is the evidence against the priesthoods of these times and places. But the whole argument is founded upon what is at least a doubtful view of human nature and of society. Just as an early school of geologists were accustomed to explain the present state of the earth's surface by supposing that in primitive ages the processes of geologic change were far more violent and rapid than they are now—so catastrophic, indeed, as to constitute a thoroughly different state of things—so there is a school of historians who think that the intimate structure of human nature, its capabilities of learning and of adapting itself to society, have so far altered within the historic period as to make the present processes of social change totally different in character from those even of the moderately distant past. They think that institutions and conditions which are plainly harmful to us now have at other times and places done good and serviceable work. War, pestilence, priestcraft, and slavery, have been represented as positive boons to an early state of society. They are not blessings to us, it is true; but then times have altered very much.

On the other hand, a later school of geologists have seen reason to think that the processes of change have never, since the earth finally solidified, been very different from what they are now. More rapid, indeed, they must have been

in early times, for many reasons; but not so very much more rapid as to constitute an entirely different state of things. And it does seem to me in like manner that a wider and more rational view of history will recognize more and more of the permanent and less and less of the changeable element in human nature. No doubt our ancestors of a thousand generations back were very different beings from ourselves; perhaps fifty thousand generations back they were not men at all. But the historic period is hardly to be stretched beyond two hundred generations; and it seems unreasonable to expect that in such a tiny page of our biography we can trace with clearness the growth and progress of a long life. Compare Egypt in the time of King Menes, say six thousand years ago, with Spain in this present century, before Englishmen made any railways there: I suppose the main difference is that the Egyptians washed themselves. It seems more analogous to what we find in other fields of inquiry, to suppose that there are certain great broad principles of human life which have been true all along; that certain conditions have always been favorable to the health of society, and certain other conditions always hurtful.

Now, although I have many times asked for it, from those who said that somewhere and at some time mankind had derived benefits from a priesthood laying claim to a magical character and powers, I have never been able to get any evidence for this statement. Nobody will give me a date, and a latitude and longitude, that I may examine into the matter. "In the middle ages the priests and monks were the sole depositaries of learning." Quite so; a man burns your house to the ground, builds a wretched hovel on the ruins, and then takes credit for whatever shelter there is about the place. In the middle ages nearly all learned men were obliged to become priests and monks. "Then, again, the bishops have sometimes acted as tribunes of the people to protect them against the tyranny of kings." No doubt when pope and Cæsar fall out honest men may come by their own. If two men rob you in a dark lane, and then quarrel over the plunder, so that you get a chance to escape with your life, you will of course be very grateful to each of them for having prevented the other from killing you; but you would be much more grateful to a policeman who locked them both up. Two powers have sought to enslave the people, and have quarreled with each other; certainly we are very much obliged to them for quarreling, but a condition of still greater happiness and security would be the non-existence of both.

I can find no evidence that seriously militates against the rule that the priest is at all times and in all places the enemy of all men—*Sacerdos semper, ubique, et omnibus inimicus.* I do not deny that the priest is very often a most earnest and conscientious man, doing the very best that he knows of as well as he can do it. Lord Amberley is quite right in saying that the blame rests more with the laity than with the priesthood: that it has insisted on magic and mysteries, and has forced the priesthood to produce them. But, then, how dreadful is the system that puts good men to such uses!

And, although it is true that in its origin a priesthood is the effect of an evil already existing, a symptom of social disease, rather than a cause of it, yet, once being created and made powerful, it tends in many ways to prolong and increase the disease which gave it birth. One of these ways is so marked and of such practical importance that we are bound to consider it here; I mean the education of children. If there is one lesson which history forces upon us in every page, it is this: *Keep your children away from the priest, or he will make them the enemies of mankind.* It is not the Catholic clergy and those like them who are alone to be dreaded in this matter; even the representatives of apparently harmless religions may do incalculable mischief if they get education into their hands. To the early Mohammedans the mosque was the one public building in every place where public business could be transacted; and so it was naturally the place of primary education, which they held to be a matter of supreme importance. By-and-by, as the clergy grew up, the mosque was gradually usurped by them, and primary education fell into their hands. Then ensued a "revival of religion;" religion became a fanaticism; books were burned and universities were closed; the empire rotted away in East and West, until it was conquered by Turkish savages in Asia and by Christian savages in Spain.

The labors of students of the early history of institutions—notably Sir Henry Maine and M. Laveleye—have disclosed to us an element of society which appears to have existed in all times and places, and which is the basis of our own social structure. The village community, or commune, or township, found in tribes of the most varied race and time, has so modified itself as to get adapted in one place or another to all the different conditions of human existence.

This union of men to work for a common object has transformed them from wild animals into tame ones. Century by century the educating process of the social life has been working at human nature; it has built itself into our inmost soul. Such as we are—moral and rational beings—thinking and talking in general conceptions about the facts that make up our life, feeling a necessity to act, not for ourselves, but for Ourself, for the larger life of man in which we are elements—such moral and rational beings, I say, man has made us. By man I mean men organized into a society which fights for its life, not only as a mere collection of men who must separately be kept alive, but as society. It must fight, not only against external enemies, but against treason and disruption within it. Hence comes the unity of interest of all its members; each of them has to feel that he is not himself only, but a part of all the rest. Conscience—the sense of right and wrong—springs out of the habit of judging things from the point of view of all, and not of one. It is Ourself, not ourselves, that makes for righteousness.

The codes of morality, then, which are adopted into various religions, and afterward taught as parts of religious systems, are derived from secular sources. The most ancient version of the Ten Commandments, whatever the investigations of scholars may make it out to be, originates, not in the thunders of Sinai, but in the peaceful life of men on the plains of Chaldea. Conscience is the voice of man ingrained into our hearts, commanding us to work for man.

Religions differ in the treatment which they give to this most sacred heirloom of our past history. Sometimes they invert its precepts—telling men to be submissive under oppression because the powers that be are ordained of God; telling them to believe where they have not seen, and to play with falsehood in order that a particular doctrine may prevail, instead of seeking for truth whatever it may be; telling them to betray their country for the sake of their church. But there is one great distinction to which I wish, in conclusion, to call special attention—a distinction between two kinds of religious emotion which bear upon the conduct of men.

We said that conscience is the voice of man within us, commanding us to work for man. We do not know this immediately by our own experience; we only know that something within us commands us to work for man. This fact men have tried to explain; and they have thought, for the most part, that this voice was the voice of a god. But the explanation takes two different forms: the god may speak in us for man's sake, or for his own sake. If he speaks for his own sake—and this is what generally happens when he has priests who lay claim to a magical character and powers—our allegiance is apt to be taken away from man, and transferred to the god. When we love our brother for the sake of our brother, we help all men to grow in the right; but when we love our brother for the sake of somebody else, who is very likely to damn our brother, it very soon comes to burning him alive for his soul's health. When men respect human life for the sake of man, tranquillity, order, and progress, go hand-in-hand; but those who only respected human life because God had forbidden murder, have set their mark upon Europe in fifteen centuries of blood and fire.

These are only two examples of a general rule. Wherever the allegiance of men has been diverted from man to some divinity who speaks to men for his own sake and seeks his own glory, one thing has happened. The right precepts might be enforced, but they were enforced upon wrong grounds, and they were not obeyed. But right precepts are not always enforced; the fact that the fountains of morality have been poisoned makes it easy to substitute wrong precepts for right ones.

To this same treason against humanity belongs the claim of the priesthood to take away the guilt of a sinner after confession has been made to it. The Catholic priest professes to act as an embassador for his God, and to absolve the guilty man by conveying to him the forgiveness of Heaven. If his credentials were ever so sure, if he were indeed the embassador of a superhuman power, the claim would be treasonable. Can the favor of the czar make guiltless the murderer of old men and women and children in Circassian valleys? Can the pardon of the sultan make clean the bloody hands of a pasha? As little can any god forgive sins committed against man. When men think he can, they compound for old sins which the god did not like by committing new ones which he does like. Many a remorseful despot has atoned for the levities of his youth by the persecution of heretics in his old age. That frightful crime, the adulteration of food, could not possibly be so common among us if men were not taught to regard it as merely objectionable because it is remotely connected with stealing, of which God has expressed his disapproval in the Decalogue; and, therefore, as quite naturally set right by a punctual attend-

ance at church on Sundays. When a Ritualist breaks his fast before celebrating the Holy Communion, his deity can forgive him, if he likes, for the matter concerns nobody else; but no deity can forgive him for preventing his parishioners from setting up a public library and reading-room for fear they should read Mr. Darwin's works in it. That sin is committed against the people, and a god cannot take it away.

I call those religions which undermine the supreme allegiance of the conscience to man *ultramontane* religions, because they seek their springs of action *ultra montes*, outside of the common experience and daily life of man. And I remark about them that they are especially apt to teach wrong precepts, and that even when they command men to do the right things they put the command upon wrong motives, and do not get the things done.

But there are forms of religious emotion which do not thus undermine the conscience. Far be it from me to undervalue the help and strength which many of the bravest of our brethren have drawn from the thought of an unseen helper of men. He who, wearied or stricken in the fight with the powers of darkness, asks himself in a solitary place, "Is it all for nothing? Shall we, indeed, be overthrown?"—he does find something which may justify that thought. In such a moment of utter sincerity, when a man has bared his own soul before the immensities and the eternities, a presence, in which his own poor personality is shriveled into nothingness, arises with him, and says, as plainly as words can say, "I am with thee, and I am greater than thou." Many names of gods, of many shapes, have men given to this presence; seeking by names and pictures to know more clearly and to remember more continually the guide and the helper of men. No such comradeship with the Great Companion shall have anything but reverence from me, who have known the divine gentleness of Denison Maurice, the strong and healthy practical instinct of Charles Kingsley, and who now revere with all my heart the teaching of James Martineau. They seem to me, one and all, to be reaching forward with loving anticipation to a clearer vision which is yet to come—*tendentesque manus ripæ ulterioris amore*. For, after all, such a helper of men, outside of humanity, the truth will not allow us to see. The dim and shadowy outlines of the superhuman deity fade slowly away from before us; and, as the mist of his presence floats aside, we perceive with greater and greater clearness the shape of a yet grander and nobler figure—of Him who made all gods and shall unmake them. From the dim dawn of history, and from the inmost depth of every soul, the face of our father Man looks out upon us with the fire of eternal youth in his eyes, and says, "Before Jehovah was, I am!"

—*Fortnightly Review.*

A BIOGRAPHICAL SKETCH OF AN INFANT.

By CHARLES DARWIN.

M. TAINE'S very interesting account of the mental development of an infant, translated in the last number of *Mind* (page 252), has led me to look over a diary which I kept thirty-seven years ago with respect to one of my own infants. I had excellent opportunities for close observation, and wrote down at once whatever was observed. My chief object was expression, and my notes were used in my book on this subject; but, as I attended to some other points, my observations may possibly possess some little interest in comparison with those by M. Taine, and with others which hereafter no doubt will be made. I feel sure, from what I have seen with my own infants, that the period of development of the several faculties will be found to differ considerably in different infants.

During the first seven days various reflex actions—namely, sneezing, hiccoughing, yawning, stretching, and, of course, sucking and screaming, were well performed by my infant. On the seventh day I touched the naked sole of his foot with a bit of paper, and he jerked it away, curling at the same time his toes, like a much older child when tickled. The perfection of these reflex movements shows that the extreme imperfection of the voluntary ones is not due to the state of the muscles or of the coördinating centres, but to that of the seat of the will. At this time, though so early, it seemed clear to me that a

warm, soft hand applied to his face excited a wish to suck. This must be considered as a reflex or an instinctive action, for it is impossible to believe that experience and association with the touch of his mother's breast could so soon have come into play. During the first fortnight he often started on hearing any sudden sound, and blinked his eyes. The same fact was observed with some of my other infants within the first fortnight. Once, when he was sixty-six days old, I happened to sneeze, and he started violently, frowned, looked frightened, and cried rather badly: for an hour afterward he was in a state which would be called nervous in an older person, for every slight noise made him start. A few days before this same date he first started at an object suddenly seen; but for a long time afterward sounds made him start and wink his eyes much more frequently than did sight; thus, when 114 days old, I shook a pasteboard box with comfits in it near his face, and he started, while the same box when empty, or any other object shaken as near or much nearer to his face, produced no effect. We may infer from these several facts that the winking of the eyes, which manifestly serves to protect them, had not been acquired through experience. Although so sensitive to sound in a general way, he was not able, even when 124 days old, easily to recognize whence a sound proceeded, so as to direct his eyes to the source.

With respect to vision, his eyes were fixed on a candle as early as the ninth day, and up to the forty-fifth day nothing else seemed thus to fix them; but on the forty-ninth day his attention was attracted by a bright-colored tassel, as was shown by his eyes becoming fixed and the movements of his arms ceasing. It was surprising how slowly he acquired the power of following with his eyes an object if swinging at all rapidly; for he could not do this well when seven and a half months old. At the age of thirty-two days he perceived his mother's bosom when three or four inches from it, as was shown by the protrusion of his lips and his eyes becoming fixed; but I much doubt whether this had any connection with vision; he certainly had not touched the bosom. Whether he was guided through smell, or the sensation of warmth, or through association with the position in which he was held, I do not at all know.

The movements of his limbs and body were for a long time vague and purposeless, and usually performed in a jerking manner; but there was one exception to this rule, namely, that from a very early period, certainly long before he was forty days old, he could move his hands to his own mouth. When seventy-seven days old, he took the sucking-bottle (with which he was partly fed) in his right hand, whether he was held on the left or right arm of his nurse, and he would not take it in his left hand until a week later, although I tried to make him do so; so that the right hand was a week in advance of the left. Yet this infant afterward proved to be left-handed, the tendency being no doubt inherited—his grandfather, mother, and a brother, having been or being left-handed. When between eighty and ninety days old, he drew all sorts of objects into his mouth, and in two or three weeks' time could do this with some skill; but he often first touched his nose with the object and then dragged it down into his mouth. After grasping my finger and drawing it to his mouth, his own hand prevented him from sucking it; but on the 114th day, after acting in this manner, he slipped his own hand down so that he could get the end of my finger into his mouth. This action was repeated several times, and evidently was not a chance but a rational one. The intentional movements of the hands and arms were thus much in advance of those of the body and legs; though the purposeless movements of the latter were from a very early period usually alternate as in the act of walking. When four months old, he often looked intently at his own hands and other objects close to him, and in doing so the eyes were turned much inward, so that he often squinted frightfully. In a fortnight after this time (i. e., 132 days old) I observed that if an object was brought as near to his face as his own hands were, he tried to seize it, but often failed; and he did not try to do so in regard to more distant objects. I think there can be little doubt that the convergence of his eyes gave him the clew and excited him to move his arms. Although this infant thus began to use his hands at an early period, he showed no special aptitude in this respect, for, when he was two years and four months old, he held pencils, pens, and other objects, far less neatly and efficiently than did his sister who was then only fourteen months old, and who showed great inherent aptitude in handling anything.

Anger.—It was difficult to decide at how early an age anger was felt; on his eighth day he frowned and wrinkled the skin round his eyes before a crying-fit, but this may have been due to pain or distress, and not to anger. When about ten weeks old, he was given some rather cold milk and he kept a slight frown on his fore-

head all the time that he was sucking, so that he looked like a grown-up person made cross from being compelled to do something which he did not like. When nearly four months old, and perhaps much earlier, there could be no doubt, from the manner in which the blood gushed into his whole face and scalp, that he easily got into a violent passion. A small cause sufficed; thus, when a little over seven months old, he screamed with rage because a lemon slipped away and he could not seize it with his hands. When eleven months old, if a wrong plaything was given him, he would push it away and beat it; I presume that the beating was an instinctive sign of anger, like the snapping of the jaws by a young crocodile just out of the egg, and not that he imagined he could hurt the plaything. When two years and three months old, he became a great adept at throwing books or sticks, etc., at any one who offended him; and so it was with some of my other sons. On the other hand, I could never see a trace of such aptitude in my infant daughters; and this makes me think that a tendency to throw objects is inherited by boys.

Fear.—This feeling probably is one of the earliest experienced by infants, as shown by their starting at any sudden sound when only a few weeks old, followed by crying. Before the present one was four and a half months old, I had been accustomed to make close to him many strange and loud noises, which were all taken as excellent jokes, but at this period I one day made a loud, snoring noise which I had never done before; he instantly looked grave and then burst out crying. Two or three days afterward, I made through forgetfulness the same noise, with the same result. About the same time (viz., on the 137th day) I approached with my back toward him and then stood motionless: he looked very grave and much surprised, and would soon have cried, had I not turned round; then his face instantly relaxed into a smile. It is well known how intensely older children suffer from vague and undefined fears, as from the dark, or in passing an obscure corner in a large hall, etc. I may give as an instance that I took the child in question, when two and a quarter years old, to the Zoological Gardens, and he enjoyed looking at all the animals which were like those that he knew, such as deer, antelopes, etc., and all the birds, even the ostriches, but was much alarmed at the various larger animals in cages. He often said afterward that he wished to go again, but not to see "beasts in houses;" and we could in no manner account for this fear. May we not suspect that the vague but very real fears of children, which are quite independent of experience, are the inherited effects of real dangers and abject superstitions during ancient savage times? It is quite conformable with what we know of the transmission of formerly well-developed characters, that they should appear at an early period of life, and afterward disappear.

Pleasurable Sensations.—It may be presumed that infants feel pleasure while sucking, and the expression of their swimming eyes seems to show that this is the case. This infant smiled when forty-five days, a second when forty-six days old; and these were true smiles, indicative of pleasure, for their eyes brightened and eyelids slightly closed. The smiles arose chiefly when looking at their mother, and were therefore probably of mental origin; but this infant often smiled then, and for some time afterward, from some inward pleasurable feeling, for nothing was happening which could have in any way excited or amused him. When 110 days old, he was exceedingly amused by a pinafore being thrown over his face and then suddenly withdrawn; and so he was when I suddenly uncovered my own face and approached his. He then uttered a little noise which was an incipient laugh. Here surprise was the chief cause of the amusement, as is the case to a large extent with the wit of grown-up persons. I believe that for three or four weeks before the time when he was amused by a face being suddenly uncovered he received a little pinch on his nose and cheeks as a good joke. I was at first surprised at humor being appreciated by an infant only a little above three months old, but we should remember how very early puppies and kittens begin to play. When four months old, he showed in an unmistakable manner that he liked to hear the pianoforte played; so that here apparently was the earliest sign of an æsthetic feeling, unless the attraction of bright colors, which was exhibited much earlier, may be so considered.

Affection.—This probably arose very early in life, if we may judge by his smiling at those who had charge of him when under two months old; though I had no distinct evidence of his distinguishing and recognizing any one, until he was nearly four months old. When nearly five months old, he plainly showed his wish to go to his nurse. But he did not spontaneously exhibit affection by overt acts until a little above a year old, namely, by kissing several times his nurse who had been absent for a short time. With respect to the allied feeling of sympathy, this was clearly shown at six months and eleven days by his melancholy

face, with the corners of his mouth well depressed, when his nurse pretended to cry. Jealousy was plainly exhibited when I fondled a large doll, and when I weighed his infant sister, he being then fifteen and a half months old. Seeing how strong a feeling jealousy is in dogs, it would probably be exhibited by infants at an earlier age than that just specified, if they were tried in a fitting manner.

Association of Ideas, Reason, etc.—The first action which exhibited, as far as I observed, a kind of practical reasoning, has already been noticed, namely, the slipping his hand down my finger so as to get the end of it into his mouth; and this happened on the 114th day. When four and a half months old, he repeatedly smiled at my image and his own in a mirror, and no doubt mistook them for real objects; but he showed sense in being evidently surprised at my voice coming from behind him. Like all infants he much enjoyed thus looking at himself, and in less than two months perfectly understood that it was an image; for if I made quite silently any odd grimace, he would suddenly turn round to look at me. He was, however, puzzled at the age of seven months, when being out-of-doors he saw me on the inside of a large plate-glass window, and seemed in doubt whether or not it was an image. Another of my infants, a little girl, when exactly a year old, was not nearly so acute, and seemed quite perplexed at the image of a person in a mirror approaching her from behind. The higher apes which I tried with a small looking-glass behaved differently; they placed their hands behind the glass, and in doing so showed their sense, but, far from taking pleasure in looking at themselves, they got angry and would look no more.

When five months old, associated ideas arising independently of any instruction became fixed in his mind: thus as soon as his hat and cloak were put on, he was very cross if he was not immediately taken out-of-doors. When exactly seven months old, he made the great step of associating his nurse with her name, so that if I called it out he would look round for her. Another infant used to amuse himself by shaking his head laterally: we praised and imitated him, saying "Shake your head;" and when he was seven months old he would sometimes do so on being told without any other guide. During the next four months the former infant associated many things and actions with words; thus when asked for a kiss he would protrude his lips and keep still—would shake his head and say in a scolding voice "Ah!" to the coal-box or a little spilt water, etc., which he had been taught to consider as dirty. I may add that when a few days under nine months old he associated his own name with his image in the looking-glass, and when called by name would turn toward the glass even when at some distance from it. When a few days over nine months, he learned spontaneously that a hand or other object causing a shadow to fall on the wall in front of him was to be looked for behind. While under a year old, it was sufficient to repeat two or three times at intervals any short sentence to fix firmly in his mind some associated idea. In the infant described by M. Taine (pp. 254–256) the age at which ideas readily became associated seems to have been considerably later, unless indeed the earlier cases were overlooked. The facility with which associated ideas due to instruction and others spontaneously arising were acquired, seemed to me by far the most strongly marked of all the distinctions between the mind of an infant and that of the cleverest full-grown dog that I have ever known. What a contrast does the mind of an infant present to that of the pike, described by Prof. Möbius,[1] who during three whole months dashed and stunned himself against a glass partition which separated him from some minnows; and when, after at last learning that he could not attack them with impunity, he was placed in the aquarium with these same minnows, then in a persistent and senseless manner he would not attack them!

Curiosity, as M. Taine remarks, is displayed at an early age by infants, and is highly important in the development of their minds; but I made no special observation on this head. Imitation likewise comes into play. When our infant was only four months old I thought that he tried to imitate sounds; but I may have deceived myself, for I was not thoroughly convinced that he did so until he was ten months old. At the age of eleven and a half months he could readily imitate all sorts of actions, such as shaking his head and saying "Ah!" to any dirty object, or by carefully and slowly putting his forefinger in the middle of the palm of his other hand, to the childish rhyme of "Pat it and pat it, and mark it with T." It was amusing to behold his pleased expression after successfully performing any such accomplishment.

I do not know whether it is worth mentioning, as showing something about the strength of memory in a young child, that this one, when three years and twenty-three days old, on being shown an engraving of his grandfather, whom he had not seen for exactly six months, instantly

[1] "Die Bewegungen der Thiere," etc., 1873, p. 11.

recognized him, and mentioned a whole string of events which had occurred while visiting him, and which certainly had never been mentioned in the interval.

Moral Sense.—The first sign of moral sense was noticed at the age of nearly thirteen months. I said, "Doddy" (his nickname) "won't give poor papa a kiss—naughty Doddy!" These words, without doubt, made him feel slightly uncomfortable; and at last, when I had returned to my chair, he protruded his lips as a sign that he was ready to kiss me; and he then shook his hand in an angry manner until I came and received his kiss. Nearly the same little scene recurred in a few days, and the reconciliation seemed to give him so much satisfaction that several times afterward he pretended to be angry and slapped me, and then insisted on giving me a kiss. So that here we have a touch of the dramatic art, which is so strongly pronounced in most young children. About this time it became easy to work on his feelings, and make him do whatever was wanted. When two years and three months old he gave his last bit of gingerbread to his little sister, and then cried out, with high self-approbation, "O kind Doddy, kind Doddy!" Two months later he became extremely sensitive to ridicule, and was so suspicious that he often thought people who were laughing and talking together were laughing at him. A little later (two years and seven and a half months old) I met him coming out of the dining-room with his eyes unnaturally bright, and an odd, unnatural or affected manner, so that I went into the room to see who was there, and found that he had been taking pounded sugar, which he had been told not to do. As he had never been in any way punished, his odd manner certainly was not due to fear, and I suppose it was pleasurable excitement struggling with conscience. A fortnight afterward I met him coming out of the same room, and he was eying his pinafore, which he had carefully rolled up; and again his manner was so odd that I determined to see what was within his pinafore, notwithstanding that he said there was nothing, and repeatedly commanded me to "go away," and I found it stained with pickle-juice; so that here was carefully-planned deceit. As this child was educated solely by working on his good feelings, he soon became as truthful, open, and tender, as any one could desire.

Unconsciousness, Shyness.—No one can have attended to very young children without being struck at the unabashed manner in which they fixedly stare without blinking their eyes at a new face; an old person can look in this manner only at an animal or inanimate object. This, I believe, is the result of young children not thinking in the least about themselves, and therefore not being in the least shy, though they are sometimes afraid of strangers. I saw the first symptom of shyness in my child when nearly two years and three months old: this was shown toward myself, after an absence of ten days from home, chiefly by his eyes being kept slightly averted from mine; but he soon came and sat on my knee and kissed me, and all trace of shyness disappeared.

Means of Communication.—The noise of crying, or rather of squalling, as no tears are shed for a long time, is, of course, uttered in an instinctive manner, but serves to show that there is suffering. After a time the sound differs according to the cause, such as hunger or pain. This was noticed when this infant was eleven weeks old, and I believe at an earlier age in another infant. Moreover, he appeared soon to learn to begin crying voluntarily, or to wrinkle his face in the manner proper to the occasion, so as to show that he wanted something. When forty-six days old, he first made little noises without any meaning to please himself, and these soon became varied. An incipient laugh was observed on the 113th day, but much earlier in another infant. At this date I thought, as already remarked, that he began to try to imitate sounds, as he certainly did at a considerably later period. When five and a half months old he uttered an articulate sound, "Da!" but without any meaning attached to it. When a little over a year old he used gestures to explain his wishes. To give a simple instance, he picked up a bit of paper, and, giving it to me, pointed to the fire, as he had often seen and liked to see paper burned. At exactly the age of a year he made the great step of inventing a word for food—namely, *mum*; but what led him to it I did not discover. And now, instead of beginning to cry when he was hungry, he used this word in a demonstrative manner or as a verb, implying "Give me food." This word, therefore, corresponds with *ham* as used by M. Taine's infant at the later age of fourteen months. But he also used *mum* as a substantive of wide signification; thus he called sugar *shu-mum*, and a little later, after he had learned the word black, he called liquorice *black-shu-mum*—black-sugar-food.

I was particularly struck with the fact that when asking for food by the word *mum* he gave

to it (I will copy the words written down at the time) "a most strongly-marked interrogatory sound at the end." He also gave to "Ah," which he chiefly used at first when recognizing any person or his own image in a mirror, an exclamatory sound, such as we employ when surprised. I remark in my notes that the use of these intonations seemed to have arisen instinctively, and I regret that more observations were not made on this subject. I record, however, in my notes that at a rather later period, when between eighteen and twenty-one months old, he modulated his voice in refusing peremptorily to do anything by a defiant whine, so as to express "That I won't;" and again his humph of assent expressed "Yes, to be sure." M. Taine also insists strongly on the highly-expressive tones of the sounds made by his infant before she had learned to speak. The interrogatory sound which my child gave to the word *mum* when asking for food is especially curious; for if any one will use a single word or a short sentence in this manner, he will find that the musical pitch of his voice rises considerably at the close. I did not then see that this fact bears on the view which I have elsewhere maintained, that before man used articulate language, he uttered notes in a true musical scale, as does the anthropoid ape Hylobates.

Finally, the wants of an infant are at first made intelligible by instinctive cries, which after a time are modified in part unconsciously, and in part, as I believe, voluntarily as a means of communication—by the unconscious expression of the features—by gestures and in a marked manner by different intonations—lastly by words of a general nature invented by himself, then of a more precise nature imitated from those which he hears; and these latter are acquired at a wonderfully quick rate. An infant understands to a certain extent, and as I believe at a very early period, the meaning or feelings of those who tend him, by the expression of their features. There can hardly be a doubt about this with respect to smiling; and it seemed to me that the infant whose biography I have here given understood a compassionate expression at a little over five months old. When six months and eleven days old he certainly showed sympathy with his nurse on her pretending to cry. When pleased after performing some new accomplishment, being then almost a year old, he evidently studied the expression of those around him. It was probably due to differences of expression, and not merely of the form of the features, that certain faces clearly pleased him much more than others, even at so early an age as a little over six months. Before he was a year old, he understood intonations and gestures, as well as several words and short sentences. He understood one word, namely, his nurse's name, exactly five months before he invented his first word *mum;* and this is what might have been expected, as we know that the lower animals easily learn to understand spoken words.—*Mind.*

ON THE PROBABLE ORIGIN AND AGE OF THE SUN.

By JAMES CROLL, LL. D., F. R. S.[1]

THE total annual amount of radiation from the whole surface of the sun is $8,340 \times 10^{30}$ foot-pounds. To maintain the present rate of radiation it would require the combustion of about 1,500 pounds of coal per hour on every square foot of the sun's surface; and were the sun composed of that material it would all be consumed in less than 5,000 years. The opinion that the sun's heat is maintained by combustion cannot be entertained for a single moment. Mr. Lockyer has suggested that the elements of the sun are, owing to its excessive temperature, in a state of dissociation, and some have supposed that this fact might help to explain the duration of the sun's heat. But it must be obvious that, even supposing we were to make the most extravagant estimate of the chemical affinities of these elements, the amount of heat derived from their combination could at most give us only a few thousand years' additional heat. Under every conceivable supposition the combustion theory must be abandoned.

It is now generally held by physicists that the enormous store of heat possessed by the sun could only have been derived from gravitation. For example, a pound of coal falling into the sun from an infinite distance would produce by its concussion more than 6,000 times the amount

[1] Of H. M. Geological Survey of Scotland, and author of "Climate and Time."

of heat that would be generated by its combustion. It would, in fact, amount to upward of 65,000,000,000 foot-pounds—an amount of energy sufficient to raise 1,000 tons to a height of five and a half miles.

There are two forms in which the gravitation theory has been presented: 1. The meteoric theory, propounded by Dr. Meyer; and, 2. The contraction theory, advocated by Helmholtz. The meteoric theory of the sun's heat has now been pretty generally abandoned for the contraction theory advanced by Helmholtz. Suppose, with Helmholtz, that the sun originally existed as a nebulous mass, filling the entire space presently occupied by the solar system, and extending into space indefinitely beyond the outermost planet. The total amount of work in foot-pounds performed by gravitation in the condensation of this mass to an orb of the sun's present size can be found by means of the following formula given by Helmholtz:

$$\text{Work of condensation} = \frac{3}{5} \cdot \frac{r^2 M^2}{Rm} \cdot g.$$

M is the mass of the sun, m the mass of the earth, R the sun's radius, and r the earth's radius. Taking—

$M = 4{,}230 \times 10^{27}$ lbs., $m = 11{,}920 \times 10^{21}$ lbs., $R = 2{,}328{,}500{,}000$ feet, and $r = 20{,}889{,}272$ feet, we have, then, for the total amount of work performed by gravitation in foot-pounds:

$$\frac{3}{5} \cdot \frac{(20{,}889{,}272.5)^2 \times (4{,}230 \times 10^{27})^2}{2{,}328{,}500{,}000 \times 11{,}920 \times 10^{21}} = 168{,}790 \times 10^{36} \text{ foot-pounds.}$$

The amount of heat thus produced by gravitation would suffice for 20,237,500 years.

The conclusions are based upon the assumption that the density of the sun is uniform throughout. But it is highly probable that the sun's density increases toward the centre, in which case the amount of work performed by gravitation would be something more than the above.

At this point, in reference to the age of our globe, Geology and Physics are generally supposed to come into direct antagonism. For, if it be true, as physicists maintain, that gravitation is the only possible source from which the sun could have derived its store of energy, then the sun could not have maintained our globe at its present temperature for more than about 20,000,000 years. "On the very highest computation which can be permitted," says Prof. Tait, "it cannot have supplied the earth, even at the present rate, for more then about 15,000,000 or 20,000,000 years."[1] The limit to the age of the sun's heat must have limited the age of the habitable globe. All the geological history of the globe would necessarily be comprehended within this period. If the sun derived its heat from the condensation of its mass, then it could not possibly be more than about 20,000,000 years since the beginning of the Laurentian period. But 20,000,000 years would be considered by most geologists to represent only a comparatively small portion of the time which must have elapsed since organic life began on our globe.

It is true that the views which formerly prevailed among geologists, in regard to the almost unlimited extent of geological time, have of late undergone very considerable modifications; but there are few geologists, I presume, who would be willing to admit that the above period is sufficient to comprehend the entire history of stratified rocks.

It is the facts of denudation which most forcibly impress the mind with a sense of immense duration, and show most convincingly the great antiquity of the earth.

We know unquestionably that many of the greatest changes undergone by the earth's crust were produced, not by convulsions and cataclysms of Nature, but by those ordinary agencies that we see at work every day around us, such as rain, snow, frost, ice, chemical action, etc. Valleys have not been produced by violent dislocations, nor the hills by upheavals, but both have been carved out of the solid rock by the silent and gentle agency of chemical action, frost, rain, ice, and running water. In short, the rocky face of our globe has been moulded into hill and dale, and ultimately worn down to the sea-level by means of these apparently trifling agents, not merely once or twice, but probably dozens of times over during past ages. Now, when we reflect that with such extreme slowness do these agents perform their work that we might, if we could, watch their operations from year to year and from century to century without being able to perceive that they make any sensible impression, we are necessitated to conclude that geological periods must be enormous. The utter inadequacy of a period of 20,000,000 years for the age of our earth is demonstrable from the enormous thickness of rock which is known to have been removed off certain areas by denudation. I shall now briefly refer to a few of the many facts which might be adduced on this point.

[1] "Recent Advances in Physical Science," p. 175.

One plain and obvious method of showing the great extent to which the general surface of the country has been lowered by denudation is furnished, as is well known, by the way in which the inequalities of surface produced by faults or dislocations have been effaced. It is quite common to meet with faults where the strata on the one side have been depressed several hundreds—and in some cases thousands—of feet below that on the other, but we seldom find any indications of such on the surface, the inequalities on the surface having been all removed by denudation. But in order to effect this a mass of rock must have been removed equal in thickness to the extent of the dislocation. The following are a few examples of large faults:

The great Irwell fault, described by Prof. Hull,[1] which stretches from the Mersey west of Stockport to the north of Bolton, has a throw of upward of 3,000 feet.

Some remarkable faults have been found by Prof. Ramsay in North Wales. For example, near Snowdon, and about a mile east-southeast of Beddgelert, there is a fault with a down-throw of 5,000 feet; and in the Berwyn Hills, between Bryn-mawr and Post-gwyn, there is one of 5,000 feet. In the Aran Range there is a great fault, designated the Bala fault, with a down-throw of 7,000 feet. Again, between Aran Mowddwy and Careg Aderyn the displacement of the strata amounts to no less than from 10,000 to 11,000 feet.[2] Here we have evidence that a mass of rock, varying from one mile to two miles in vertical thickness, must have been denuded in many places from the surface of the country in North Wales.

The fault which passes along the east side of the Pentlands is estimated to have a throw of upward of 3,000 feet.[3] Along the flank of the Grampians a great fault runs from the North Sea at Stonehaven to the estuary of the Clyde, throwing the Old Red Sandstone on end sometimes for a distance of two miles from the line of dislocation. The amount of the displacement, Prof. Geikie[4] concludes, must be in some places not less than 5,000 feet, as indicated by the position of occasional outliers of conglomerate on the Highland side of the fault.

The great fault crossing Scotland from near Dunbar to the Ayrshire coast, and which separates the Silurians of the south of Scotland from the Old Red Sandstone and Carboniferous tracts of the north, has been found, by Mr. B. N. Peach, of the Geological Survey,[1] to have in some places a throw of fully 15,000 feet. This great dislocation is older than the Carboniferous period, as is shown by the entire absence of any Old Red Sandstone on the south side of the fault, and by the occurrence of the Carboniferous Limestone and Coal-measures lying directly on the Silurian rocks. We obtain here some idea of the enormous amount of denudation which must have taken place during a comparatively limited geological epoch. So vast a thickness of Old Red Sandstone could not, as Mr. Peach remarks, "have ended originally where the fault now is, but must have swept southward over the Lower Silurian uplands. Yet these thousands of feet of sandstones, conglomerates, lavas, and tuffs, were so completely removed from the south side of the fault previous to the deposition of the Carboniferous Limestone series and the Coal-measures, that not a fragment of them is anywhere to be seen between these latter formations and the old Silurian floor." This enormous thickness of nearly three miles of Old Red Sandstone must have been denuded away during the period which intervened between the deposition of the Lower Old Red Sandstone and the accumulation of the Carboniferous Limestone.

Near Tipperary, in the south of Ireland, there is a dislocation of the strata of not less than 4,000 feet,[2] which brings down the Coal-measures against the Silurian rocks. Here 1,000 feet of Old Red Sandstone, 3,000 feet of Carboniferous Limestone, and 800 feet of Coal-measures have been removed by denudation off the Silurian rocks. Not only has this immense thickness of beds been carried away, but the Silurian itself, on which they rested, has been eaten down in some places into deep valleys several hundreds of feet below the surface on which the Old Red Sandstone rested.

Faults to a similar extent abound on the Continent and in America, but they have not been so minutaly examined as in this country. In the valley of Thessolon, to the north of Lake Huron, there is a dislocation of the strata to the extent of 9,000 feet.[3]

In front of the Chilowee Mountains there is a vertical displacement of the strata of more than

[1] "Memoirs of the Geological Survey of Lancashire," 1862.

[2] "Memoirs of the Geological Survey of Great Britain," vol. iii.

[3] "Memoir to Sheet 32," Geological Survey-map of Scotland.

[4] *Nature*, vol. xiii., p. 390.

[1] "Explanation to Sheet 15," Geological Survey-map of Scotland.

[2] Jukes's and Geikie's "Manual of Geology," p. 441.

[3] "Geology of Canada," 1863, p. 61.

10,000 feet.[1] Prof. H. D. Rogers found in the Appalachian coal-fields faults ranging from 5,000 feet to more than 10,000 feet of displacement.

There are other modes than the foregoing, by means of which geologists are enabled to measure the thickness of strata which may have been removed in places off the present surface of the country, into the details of which I need not here enter. But I may give a few examples of the enormous extent to which the country, in some places, has been found to have been lowered by denudation.

Prof. Geikie has shown[2] that the Pentlands must at one time have been covered with upward of a mile in thickness of Carboniferous rocks which have all been removed by denudation.

In the Bristol coal-fields, between the river Avon and the Mendips, Prof. Ramsay has shown[3] that about 9,000 feet of Carboniferous strata have been removed by denudation from the present surface.

Between Bendrick Rock and Garth Hill, South Glamorganshire, a mass of Carboniferous and Old Red Sandstone, of upward of 9,000 feet, has been removed. At the vale of Towy, Caermarthenshire, about 6,000 feet of Silurian and 5,000 feet of Old Red Sanstone—in all about 11,000 vertical feet—have been swept away. Between Llandovery and Aberaeron a mass of about 12,000 vertical feet of the Silurian series has been removed by denudation. Between Ebwy and the forest of Dean, a distance of upward of twenty miles, a thickness of rock varying from 5,000 to 10,000 feet has been abstracted.

Prof. Hull found[4] on the northern flanks of the Pendle Range, Lancashire, the Permian beds resting on the denuded edges of the Millstone Grit, and these were again observed resting on the Upper Coal-measures south of the Wigan coal-field. Now, from the known thickness of the Carboniferous series in this part of Lancashire, he was enabled to calculate approximately the quantity of Carboniferous strata which must have been carried away between the period of the Millstone Grit and the deposition of the Permian beds, and found that it actually amounted to no less than 9,900 feet. He also found in the vale of Clitheroe, and at the base of the Pendle Range, that the Coal-measures, the whole of the Millstone Grit, the Yoredale series, and part of the Carboniferous Limestone, amounting in all to nearly 20,000 feet, had been swept away—an amount of denudation which, as Prof. Hull remarks, cannot fail to impress us with some idea of the prodigious lapse of time necessary for its accomplishment.

In the Nova Scotia coal-fields one or two miles in thickness of strata have been removed in some places.[1]

It may be observed that, enormous as is the amount of denudation indicated by the foregoing figures, these figures do not represent in most cases the actual thickness of rock removed from the surface. We are necessitated to conclude that a mass of rock equal to the thickness stated must have been removed, but we are in most cases left in uncertainty as to the total thickness which has actually been carried away. In the case of a fault, for example, with a displacement of (say) one mile, where no indication of it is seen at the surface of the ground, we know that on one side of the fault a thickness of rock equal to one mile must have been denuded, but we do not know how much more than that may have been removed. For anything which we know to the contrary, hundreds of feet of rock may have been removed before the dislocation took place, and as many more hundreds after all indications of dislocation had been effaced at the surface.

But it must be observed that the total quantity of rock which has been removed from the *present* surface of the land is evidently small in proportion to the total quantity removed during the past history of our globe. For those thousands and thousands of feet of rock which have been denuded were formed out of the waste of previously-existing rocks, just as these had been formed out of the waste of yet older rock-masses. In short, as a general rule, the rocks of one epoch have been formed out of those of preceding periods, and go themselves to form those of subsequent epochs.

In many of the cases of enormous denudation to which we have referred the erosion has been effected during a limited geological epoch. We have, for example, seen that upward of a mile in thickness of Carboniferous rock has been denuded in the area of the Pentlands. But the Pentlands themselves, it can be proved, existed as hills, in much their present form, before the Carboniferous rocks were laid down over them; and as they are of Lower Old Red Sandstone age, and have been formed by denudation, they

[1] Safford's "Geology of Tennessee," p. 309.

[2] Memoir to Sheet 32, "Geological Survey of Scotland."

[3] "Denudation of South Wales;" "Memoirs of Geological Survey," vol. i.

[4] *Quarterly Journal of the Geological Society*, vol. xxiv., p. 323.

[1] Lyell's "Student's Manual," chap xxiii.

must consequently have been carved out of the solid rock between the period of the Old Red Sandstone and the beginning of the Carboniferous age. This affords us some conception of the immense lapse of time represented by the Middle and Upper Old Red Sandstone periods.

Again, in the case of the great fault separating the Silurians of the south of Scotland from the Old Red Sandstone tracts lying to the north, a thickness of the latter strata of probably more than a mile, as we have seen, must have been removed from the ground to the south of the fault before the commencement of the Carboniferous period. And, again, in the case of the Lancashire coal-fields, to which reference has been made, nearly two miles in thickness of strata had been removed in the interval which elapsed between the Millstone Grit and the Permian periods.

As we are enabled, from geological evidence, to form some rough estimate of the extent to which the country in various places has been lowered by subaërial denudation during a given epoch, it is evident that we should have a means of arriving at some idea of the length of that epoch, did we know the probable rate at which the denudation took place. If we had a means of forming even the roughest estimate of the probable average rate of subaërial denudation during past ages, we should be enabled thereby to assign approximately an inferior limit to the age of the stratified rocks. We could then tell, at least, whether the amount of subaërial denudation known to have been effected during past geological ages could have been accomplished within 20,000,000 years or not, and this is about all with which we are at present concerned. And if it can be proved that a period of 20,000,000 years is much too short to account for the amount of denudation known to have taken place, then it is certain that the gravitation theory cannot explain the origin and source of the sun's heat.

A very simple and obvious method of determining the present mean rate of subaërial denudation was pointed out several years ago,[1] viz., that the rate of denudation must be equal to the rate at which the materials are carried off the land into the sea. But the rate at which the materials are thus abstracted is measured by the rate at which sediment is carried down by our rivers. Consequently, in order to determine the present rate of subaërial denudation, we have only to ascertain the quantity of sediment annually carried down by the river-systems.

Very accurate measurements have been made of the quantity of sediment carried down into the Gulf of Mexico by the river Mississippi, and it is found to amount to 7,474,000,000 cubic feet. The area drained by the river is 1,224,000 square miles. Now, 7,474,000,000 cubic feet removed from 1,224,000 square miles of surface is equal to $\frac{1}{4566}$ of a foot off the surface per annum, or one foot in 4,566 years. The specific gravity of the sediment is taken at 1.9, and that of the rock at 2.5; consequently the amount removed is equal to one foot of rock in about 6,000 years. For many reasons there are few rivers better adapted for affording us a fair average of the rate of subaërial denudation than the Mississippi. In reference to the above I may here quote the words of Sir Charles Lyell: "There seems," he says, "no danger of our overrating the mean rate of waste by selecting the Mississippi as our example, for that river drains a country equal to more than half the Continent of Europe, extends through twenty degrees of latitude, and therefore through regions enjoying a great variety of climate, and some of its tributaries descend from mountains of great height. The Mississippi is also more likely to afford us a fair test of ordinary denudation, because, unlike the St. Lawrence and its tributaries, there are no great lakes in which the fluviatile sediment is thrown down and arrested on its way to the sea."[1]

Rough estimates have been made of the sediment carried down by some eight or ten European rivers; and, although those estimates cannot be depended upon as being anything like accurate, still they show that it is extremely probable that the European Continent is being denuded at about the same rate as the American.

I think we may safely assume, without the risk of any great error, that the average rate of subaërial denudation during past geological ages did not differ much from the present. The rate at which a country is lowered by subaërial denudation is determined[2] not so much by the character of its rocks as by the sedimentary carrying-power of its river-systems. And this again depends mainly upon the amount of rainfall, the slope of the ground, and the character of the soil and vegetation covering the surface of the country. And, in respect of these, we have no reason

[1] *Philosophical Magazine*, May, 1868; February, 1867. "Climate and Time," chap. xx. *See* also "Transactions of the Geological Society of Glasgow," vol. iii.

[1] "Student's Manual of Geology," p. 91 (second edition).

[2] *See* "Climate and Time," p. 334.

to believe that the present is materially different from the past. No doubt the average rainfall during some past epochs might have been greater than at present, but there is just as little reason to doubt that during other epochs it might have been less than now. We may, therefore, conclude that about one foot of rock removed from the general surface of the country in 6,000 years may be regarded as not very far from the average rate of denudation during past ages.

But some of the cases we have given of great denudation refer to comparatively small areas, and others to beds which form anticlinal axes, and which, as is well known, denude more rapidly than either synclinal or horizontal beds. We shall, therefore — to prevent the possibility of over-estimating the length of time necessary to effect the required amount of denudation—assume the rate to have been double the above, or equal to one foot in 3,000 years.

To lower the country one mile by denudation would therefore require, according to the above rate, about 15,000,000 years; but we have seen that a thickness of rock more than equal to that must have been swept away since the Carboniferous period. For, even during the Carboniferous period itself, more than a mile in thickness of strata in many places was removed. Again, there can be no doubt whatever that the amount of rock removed during the Old Red Sandstone period was much greater than one mile; for we know perfectly well that over large tracts of country nearly a mile in thickness of rock was carried away between the period of the Lower Old Red Sandstone and the Carboniferous epoch. Further, all geological facts go to show that the time represented by the Lower Old Red Sandstone itself must have been enormous.

Now, three miles of rock removed since the commencement of the Old Red Sandstone period (which in all probability is an under-estimate) would give us 45,000,000 years.

Again, going further back, we find the lapse of time represented by the Silurian period to be even more striking than that of the Old Red Sandstone. The unconformities in the Silurian series indicate that many thousands of feet of these strata were denuded before overlying members of the same great formations were deposited. And again, this immense formation was formed in the ocean by the slow denudation of preëxisting Cambrian continents, just as these had been built up out of the ruins of the still prior Laurentian land. And even here we do not reach the end of the series, for the very Laurentians themselves resulted from the denudation, not of the primary rocks of the globe, but of previously-existing sedimentary and probably igneous rocks, of which, perhaps, no recognizable portion now remains.

Few familiar with the facts of geology will consider it too much to assume that the time which had elapsed prior to the Old Red Sandstone was equal to the time which has elapsed since that period. But if we make this assumption, this will give us at least 90,000,000 years as the age of the stratified rocks.

That the foregoing is not an over-estimate of the probable amount of rock removed by sub-aërial denudation during past geological ages will appear further evident from the following considerations: The mountain-ridges of our globe, in most cases, as is well known, have been formed by sub-aërial denudation; they have been carved out of the solid block. They stand 2,000, 4,000, or 5,000 feet high, as the case may be, simply because 2,000, 4,000, or 5,000 feet of rock have been denuded from the surrounding country. The mountains are high simply because the country has been lowered. But it must be observed that the height which the mountains reach above the surrounding country does not measure the full extent to which the country has been lowered by denudation, because the mountains themselves have also been lowered. The height of the mountains represents merely the extent to which the country has been lowered. In the formation of a mountain by denudation, say 3,000 feet in height, probably more than 6,000 feet of strata may have been removed from the surrounding country. The very fact of a mountain standing above the surrounding country exposes it the more to denudation, and it is certainly not an exaggerated assumption to suppose that while the general surface of the country was being lowered 6,000 feet by denudation, the mountain itself was at least lowered by 3,000 feet.

The very common existence of mountains 2,000 or 3,000 feet in height, formed by sub-aërial denudation, proves that at least one mile must have been worn off the general surface of the country. It does not, of course, follow that the general surface ever stood at an elevation of one mile above the sea-level, since denudation would take place as the land gradually rose. We know that the land was once under the sea, for it was there that it was formed. It is built up out of the materials resulting from the carving out into hill and dale, through countless ages, of a previously-existing land, just as this latter had

resulted from the destruction of a still older land, and so on in like manner back into the unknown past.

It has now been proved, by the foregoing very simple and obvious method, that the age of the earth must be far more than 20,000,000 or 30,000,000 years. This method, it is true, does not enable us to determine with anything like accuracy the actual age of the globe, but it enables us to determine with absolute certainty that it must be far greater than 20,000,000 years. We have not sufficient data to determine how many years have elapsed since life began on the globe, for we do not know the total amount of rock removed by denudation; but we have data perfectly sufficient to show that it began far more than twice 20,000,000 years ago.

But if the present order of things has been existing for more than 20,000,000 years, then the sun must have been illuminating our globe for that period, and, if so, then there must have been some other source than that of gravitation from which the sun derived its energy, for gravitation, as we have seen, could only have supplied the present rate of radiation for about one-half that period.

It is perfectly true, as has been stated, that the length of time that the sun could, by its radiation, have kept the earth in a state fit for animal and vegetable life, must have been limited by the store of energy in the form of heat which it possessed. But it does not follow as a necessary consequence, as is generally supposed, that this store of energy must have been limited to the amount obtained from gravity in the condensation of the sun's mass. The utmost that any physicist is warranted in affirming is simply that it is impossible for him to *conceive* of any other source. His *inability*, however, to conceive of another source cannot be accepted as a proof that there *is* no other source. But the physical argument that the age of our earth must be limited by the amount of heat which could have been received from gravity is in reality based upon this assumption—that, because no other source can be conceived of, there is no other source.

It is perfectly obvious, then, that this mere negative evidence against the possibility of the age of our habitable globe being more than 20,000,000 or 30,000,000 years is of no weight whatever when pitted against the positive evidence here advanced that its age must be far greater.

Now, in proving that the antiquity of our habitable globe must be far greater than 20,000,000 or 30,000,000 years, we prove that there must have been some other source in addition to gravity from which the sun derived his store of energy; *and this is the point which I have been endeavoring to reach by this somewhat lengthy discussion.*

Are we really under any necessity of assuming that the sun's heat was wholly, or even mainly, derived from the condensation of his mass by gravity? According to Helmholtz's theory of the origin of the sun's heat by condensation, it is assumed that the matter composing the sun, when it existed in space as a nebulous mass, was not originally possessed of temperature, but that the temperature was given to it as the mass became condensed under the force of gravitation. It is supposed that the heat given out was simply the heat of condensation. But it is quite conceivable that the nebulous mass might have been possessed of an original store of heat previous to condensation.

It is quite possible that the very reason why it existed in such a rarefied or gaseous condition was its excessive temperature, and that condensation only began to take place when the mass began to cool down. It seems far more probable that this should have been the case than that the mass existed in so rarefied a condition without temperature. For why should the particles have existed in this separate form when devoid of the repulsive energy of heat, seeing that, in virtue of gravitation, they had such a tendency to approach one another?

It will not do to begin with the assumption of a cold nebulous mass, for, the moment that the mass existed as such, condensation—under the influence of the mutual attraction of its particles—would commence. We must therefore assume either that the mass was created at the moment condensation began, or that, prior to this moment, it existed under some other form. There are few, I think, who would be willing to adopt the former alternative. If we adopt the latter we must then ask the question, "In what condition did this mass exist prior to the commencement of condensation?" The answer to this question would naturally be that it existed in a condition of excessive temperature, the repulsive force of heat preventing the particles approaching one another. In short, the excessive temperature was the very cause of the nebulous condition.

But if the mass was originally in a heated condition, then in condensing it would have to part not only with the heat of condensation, but

also with the heat which it originally possessed.

It is therefore evident that if we admit that the nebulous mass was in a state of incandescence prior to condensation, it will really be difficult to fix any limit either to the age of the sun or to the amount of heat which it may have originally possessed. The 20,000,000 years' heat obtained by condensation may in such a case be but a small fraction of the total quantity possessed by the mass.

The question now arises: "By what means could the nebulous mass have become incandescent? From what source could the heat have been obtained?" The dynamical theory of heat affords, as was shown several years ago,[1] an easy answer to this question. The answer is that *the energy in the form of heat possessed by the mass may have been derived from motion in space.* Two bodies, each one-half the mass of the sun, moving directly toward each other with a velocity of 476 miles per second, would by their concussion generate in a *single moment* 50,000,000 years' heat. For two bodies of that mass, moving with a velocity of 476 miles per second, would possess $4{,}149 \times 10^{38}$ foot-pounds of kinetic energy, and this converted into heat by the stoppage of their motion would give out an amount of heat which would cover the present rate of the sun's radiation for a period of 50,000,000 years.

Why may not the sun have been composed of two such bodies? And why may not the original store of heat possessed by him have all been derived from the concussion of these two bodies? Two such bodies coming into collision with that velocity would be dissipated into vapor and converted into a nebulous mass by such an inconceivable amount of heat as would thus be generated; and when condensation on cooling took place, a spherical mass like that of the sun would result. It is perfectly true that two such bodies could never attain the required amount of velocity by their mutual gravitation toward each other. But there is no necessity whatever for supposing that their velocities were derived from their mutual attraction alone: they might have been approaching each other with the required velocity wholly independent of gravitation.

We know nothing whatever regarding the absolute motion of bodies in space; and, beyond the limited sphere of our observation, we know nothing even of their relative motions. There may be bodies moving in relation to our system with inconceivable velocity. For anything that we know to the contrary, were one of these bodies to strike our earth the shock might be sufficient to generate an amount of heat that would dissipate the earth into vapor, though the striking body might not be heavier than a cannon-ball. There is, however, nothing very extraordinary in the velocity which we have found would be required to generate the 50,000,000 years' heat in the case of the two supposed bodies. A comet having an orbit extending to the path of the planet Neptune, approaching so near the sun as to almost graze his surface in passing, would have a velocity of about 390 miles per second, which is within 86 miles of that required.

It must be borne in mind, however, that the 476 miles per second is the velocity at the moment of collision; but more than one-half of this would be derived from the mutual attraction of the two bodies in their approach to each other. Suppose, for simplicity of calculation, each body to be equal in volume to the sun, and of course one-half the density, the amount of velocity which they would acquire by their mutual attraction would be 274 miles per second. Consequently we have to assume an original or projected velocity of only 202 miles per second. And if the original velocity was 676 per second, the total amount of heat generated would suffice for 200,000,000 years at the present rate of radiation.

On former occasions[1] I expressed it as my opinion that the total quantity of heat possessed by the sun could not probably exceed 100,000,000 years' heat. But if we admit that the heat was derived from motion in space, there really does not seem any reason why it may not be double that amount.

It will be asked, "Where did the two bodies get their motion?" It may as well, however, be asked, "Where did they get their existence?" It is just as easy to conceive that they always existed in motion as to conceive that they always existed at rest. In fact, this is the only way in which energy can remain in a body without dissipation in space. Under other forms a certain amount of the energy is constantly being transformed into heat which never can be retransformed back again, but is dissipated into space as radiant heat. But a body moving in void stellar space will, unless a collision takes place, retain its energy in the form of motion untransformed forever.

[1] *Philosophical Magazine* for May, 1868.

[1] *Philosophical Magazine*, May, 1868; "Climate and Time," chapter xxi.

It will perhaps be urged as an objection that we have no experience of bodies moving in space with velocities approaching to anything like 400 or 600 miles per second. A little consideration will, however, show that this is an objection which can hardly be admitted, as we are not in a position to be able to perceive bodies moving with such velocities. No body moving at the rate of 400 miles per second could remain as a member of our solar system. Beyond our system, the only bodies visible to us are the nebulæ and fixed stars, and they are visible because they are luminous. But the fixed stars are beyond doubt suns similar to our own; and, if we assume that the energy in the form of heat and light possessed by our sun has been derived from motion in space, we are hardly warranted in denying that the light and heat possessed by the stars were derived from another source. It is true that the motion of the stars in relation to one another, or in relation to our system (and this is the only motion known to us), is but trifling in comparison to what we even witness in our solar system. But this is what we ought, *a priori*, to expect; for if their light and heat were derived from motion in space, like that of our sun, then, like the sun, they must have lost their motion. In fact, *they are suns, and visible because they have lost their motion.* Had not the masses of which these suns were composed lost their motion they would have been non-luminous, and of course totally invisible to us. In short, we only see in stellar space those bodies which, by coming into collision, have lost their motion, for it is the lost motion which renders them luminous and visible.[1]

[1] When the foregoing theory of the origin of the sun's heat was advanced, in 1868, I was not aware that a paper on the "Physical Constitution of the Sun and Stars" had been read before the Royal Society by Mr. G. Johnstone Stoney, in which he suggested that the heat possessed by the stars may have been derived from collisions with one another. "If two stars," he says, "should be brought by their proper motion very close, one of three things would happen: Either they would pass quite clear of one another, in which case they would recede to the same immense distance asunder from which they had come; or they would become so entangled with one another as to emerge from the frightful conflagration which would ensue, as one star; or, thirdly, they would brush against one another, but not to the extent of preventing the stars from getting clear again." In the latter case he considers a double star is formed. Mr. Stoney's paper, though read in 1867, was not published till 1869.

Mr. Herbert Spencer, in his "First Principles" (pp. 532–535), has also directed attention to the fact that the stars distributed through space must tend, under the influence of gravity, to concentrate and become locally aggregated. Separate aggregations will be drawn toward one another, and ultimately coalesce. The result will be that the heat evolved by such collisions taking place under the enormous velocities acquired by gravity must have the effect of dissipating the matter of which they are composed into the gaseous state.

Both Mr. Stoney and Mr. Spencer consider the motions of the cosmic masses to be due wholly to gravity, but, as we have seen, gravity alone cannot account for the enormous amount of energy originally possessed by the sun.

The formation of a sun by collision is an event that would not be likely to escape observation if it occurred within the limits of visibility in space. But such an event must be of very rare occurrence, or the number of stars visible would be far greater than it is. The number of stars registered down to the seventh magnitude, inclusive, is—according to Herschel—somewhere between 12,000 and 15,000, and this is all that can possibly be seen by the naked eye. Now, if we suppose each of them to shine like our sun for (say) 100,000,000 years, then one formed in every 7,000 or 8,000 years would maintain the present number undiminished. But this is the number included in both hemispheres, so that the occurrence of an event of such unparalleled splendor and magnificence as the formation of a star or rather nebula—for this would be the form first assumed—is what can only be expected to be seen on our hemisphere once in about 15,000 years.

The absence of any historical record of such an event having ever occurred can therefore be no evidence whatever against the theory.

NOTE ON SIR WILLIAM THOMSON'S ARGUMENTS FOR THE AGE OF THE EARTH.

Sir William Thomson has endeavored to prove the recent age of the earth by three well-known arguments of a purely physical nature: The first is based on the age of the sun's heat; the second, on the tidal retardation of the earth's rotation; and the third, on the secular cooling of the earth.

Argument from the Age of the Sun's Heat.—It will be obvious that, if what has already been advanced in regard to the origin of the sun's heat be correct, it will follow that the argument for the recent age of the earth, based upon the assumption that the sun could have derived its store of heat only from the condensation of its mass, must be wholly abandoned, and that, in so far as this argument is concerned, there is no known limit to the amount of heat which the sun

may have possessed, or to the time during which it may have illuminated the earth.

Argument from Tidal Retardation.—It is well known that, owing to tidal retardation, the rate of the earth's rotation is slowly diminishing; and it is therefore evident that, if we go back for many millions of years, we reach a period when the earth must have been rotating much faster than now. Sir William's argument is,[1] that had the earth solidified several hundred millions of years ago, the flattening at the poles, and the bulging at the equator, would have been much greater than we find them to be. Therefore, because the earth is so little flattened, it must have been rotating, when it became solid, at very nearly the same rate as at present. And as the rate of rotation is becoming slower and slower, it cannot be so many millions of years back since solidification took place. A few years ago I ventured to point out[2] what appeared to be a very obvious objection to this argument, viz., that the influence of subaërial denudation in altering the form of the earth had been entirely overlooked. It has been proved, as we have seen, that the rocky surface of our globe is being lowered, on an average, by subaërial denudation, at the rate of about one foot in 6,000 years. It follows, as a consequence, from the loss of centrifugal force resulting from the retardation of the earth's rotation occasioned by the friction of the tidal wave, that the sea-level must be slowly sinking at the equator, and rising at the poles. This, of course, tends to protect the polar regions and expose equatorial regions to subaërial denudation. Now, it is perfectly obvious that, unless the sea-level at the equator has, in consequence of tidal retardation, been sinking during past ages at a greater rate than one foot in 6,000 years, it is physically impossible the form of our globe could have been very much different from what it is at present, whatever may have been its form when it consolidated, because subaërial denudation would have lowered the equator as rapidly as the sea sank. But in equatorial regions the rate of denudation is, no doubt, much greater than one foot in 6,000 years, because there the rainfall is greater than in the temperate regions. It has been shown that the rate at which a country is being lowered by subaërial denudation is mainly determined not so much by the character of its rocks as by the sediment-carrying power of its river-systems. Consequently, other things being equal, the greater the rainfall the greater will be the rate of denudation. We know that the basin of the Ganges, for example, is being lowered by denudation at the rate of about one foot in 2,300 years; and this is probably not very far from the average rate at which the equatorial regions are being denuded. It is therefore evident that subaërial denudation is lowering the equator as rapidly as the sea-level is sinking from loss of rotation, and that consequently we cannot infer from the present form of our globe what was its form when it solidified. In as far as tidal retardation can show to the contrary, its form, when solidification took place, may have been as oblate as that of the planet Jupiter. There is another circumstance which must be taken into account. The lowering of the equator, by the transference of materials from the equator to the higher latitudes, must tend to increase the rate of rotation, or, more properly, it must tend to lessen the rate of tidal retardation.

The argument may be shown to be inconclusive from another consideration. The question as to whether the earth's axis of rotation could ever have changed to such an extent as to have affected the climate of the poles, is at present exciting a good deal of attention. The subject has recently been investigated with great care by Prof. Houghton,[1] Mr. George Darwin,[2] the Rev. J. F. Twisden,[3] and others, and the general result arrived at may be expressed in the words of Mr. G. Darwin: "If the earth be quite rigid no redistribution of matter in new continents could ever have caused the deviation of the pole from its present position to exceed the limit of about 3°."

Mr. Darwin has shown that, in order to produce a displacement of the pole to the extent of only 1° 46′, an area equal to one-twentieth of the entire surface of the globe would have to be elevated to the height of two miles. The entire continent of Europe elevated two miles would not deflect the pole much over half a degree. Assuming the mean elevation of the continents of Europe and Asia to be 1,000 feet, Prof. Houghton calculates that their removal would displace the pole only 199.4 miles.

It may now be admitted as settled that if the earth be perfectly rigid the climate of our globe could never possibly have been affected by any

[1] "Transactions of the Geological Society of Glasgow," vol. iii., p. 1.

[2] *Nature*, August 21, 1872; "Climate and Time," p. 335.

[1] "Proceedings of the Royal Society," vol. xxvi., p. 51.

[2] "Proceedings of the Royal Society," vol. xxv., p. 328.

[3] Paper read before the Geological Society, February 21, 1877.

change in the axis of rotation. But it is maintained that if the earth can yield as a whole, so as to adapt its form to a new axis of rotation, the effects may be cumulative, and that a displacement of the pole as much as 10° or 15° is possible.[1]

But then if the earth be able to adapt its form to a *change in the axis of rotation*, there is no reason why it may not be able to adapt its form to a *change in the rate of rotation*, and, if so, the flattening at the poles and the bulging at the equator would diminish as the rate of rotation diminished, even supposing there were no denudation going on.

Argument from the Secular Cooling of the Earth.—The earth, like the sun, is a body in the process of cooling, and it is evident that if we go back sufficiently far we shall reach a period when it was in a molten condition. Calculating by means of Fourier's mathematical theory of the conductivity of heat, Sir William Thomson has endeavored to determine how many years must have elapsed since solidification of the earth's crust may have taken place. This argument is undoubtedly the most reliable of the three. Nevertheless, the data on the subject are yet very imperfect, so that no definite and trustworthy result can be arrived at by this means as to the actual age of the earth. In fact, this is obvious from the very wide limits assigned by him within which solidification probably took place. "We must," quoting Sir William's own words on the subject, "allow very wide limits on such an estimate as I have attempted to make; but I think we may, with much probability, say that the consolidation cannot have taken place less than 20,000,000 years ago, or we should have more underground heat than we actually have—nor more than 400,000,000 years ago, or we should not have so much as the least observed underground increment of temperature. That is to say, I conclude that Leibnitz's epoch of 'emergence' of the 'consistentur status' was probably within these dates." [1]

—*Quarterly Journal of Science.*

[1] A displacement of the pole of less than 15° or 20° would be of very little service in accounting for the warm climate of Greenland during the Miocene and other periods. But a displacement to that extent, even supposing that we admit the earth to be yielding, demands a condition of things which few geologists would be willing to grant. When it becomes generally recognized to what an enormous extent the temperature of the arctic regions is dependent upon ocean-currents, the difficulties in understanding how those regions have once enjoyed a temperate climate will disappear. Were the ice removed from Greenland that region would at present enjoy a warm summer, suitable for plant and animal life. It is the presence of ice rather than a positive deficiency of heat that makes Greenland so cold and barren (*see* "Climate and Time," chapter iv.). An increase in the quantity of heat conveyed by ocean-currents, merely sufficient to prevent the accumulation of ice, would completely transform the climate of the arctic lands. And such an increase would take place during an Inter-glacial period when the eccentricity of the earth's orbit was at a high value and the winter solstice in perihelion.

THE PLANET OF WAR.

AMID wars and rumors of war, the planet which has for its symbol the spear and shield of the old Assyrian war-men approaches one of those points of its epicyclic orbit about the earth where it is at its nearest to us. In the earlier part of the Crimean War, Mars shone in our midnight skies, though not so splendidly as he will shine in August and September of the present year. In the early spring of 1854—

" . . . . At a time of the year
When the face of night is fair on the dewy downs,
And the shining Daffodil dies and the Charioteer
And starry Gemini hang like glorious crowns
Over Orion's grave low down in the west,"

the spirit of Maud—

" . . . Seemed to divide in a dream from a band of the blest
And spoke of a hope for the world in the coming wars—
. . . . and pointed to Mars
As he glowed like a ruddy shield on the Lion's breast."

The poet expressed the feeling of the day, though the hope of which he sang was not the hope with which men now watch the signs of war. But if Mars were in truth the planet of war, if his influence, poured from near at hand upon the nations of this earth, excited them to war and bloodshed, we might well fear that the coming months would bring desolation on many fair terrestrial

[1] "Transactions of the Royal Society of Edinburgh," vol. xxiii., p. 161.

fields. For Mars has not blazed so fiercely in our skies since 1845, nor will he so shine again for forty-seven years, as during the last days of August and the opening days of September. Moreover, twice during his time of greatest splendor his rays will be closely conjoined with those of the malignant planet Saturn, the greater Infortune, as Mars himself is the lesser Infortune, of astrological systems.

The ruddy hue of this planet, justifying the evil qualities attributed to it by nations believing in planetary influences, has been noted from the earliest times. The Greeks called Mars the fiery planet; the Hebrews gave to it a name signifying "enkindled;" the Indians called it Angaraka, or burning charcoal, and sometimes Lohitanga, or the red orb. Ruddy stars also were compared with Mars, as the chief of all the ruddy stars—so that the name Antares, given to the star which glows like a fiery coal in the heart of the Scorpion, signifies that in ruddiness that star is a rival of Mars or Ares.

Recent researches among the ruins of Nineveh have brought to light cuneiform inscriptions relating to the celestial bodies, and among others to the planet Mars. It would appear that a treatise, in sixty books, called "The Observations of Bel," belonged formerly to the public library of Nineveh. Its date cannot have been later than the seventeenth century before our era, and the observations recorded in it extend over more than 500 years, so that the earliest bore date about 2540 B. C. One of the books was devoted to the pole-star—not our present 'pole-star, but the star Alpha of the Dragon, at that time the bright star which lay nearest the pole of the heavens. Another book was devoted to Venus; a third to Mars. We find that even at the remotest time to which these records relate, that is, more than 2,500 years before our era, the planet Mars presided (as a deity) over the third day of the week, the other planets ruling the days in the order indicated by the present nomenclature, the Sun presiding over Sunday, the Moon over Monday, Mars over Tuesday (or Mardi), Mercury over Wednesday (or Mercredi), Jupiter over Thursday (or Jeudi, Jove's day), Venus over Friday (or Vendredi), and Saturn, the gloomiest and most malignant, but also the most powerful of the planetary deities, over Saturday, the sabbath-day, when, owing to his evil influence, no work could safely be undertaken. Doubtless Tuesday was as rigidly set aside for the initiation of all warlike enterprises as Saturday for the avoidance of all labor whatsoever.

If only astrology had been a true method of prediction, the discovery of the true nature of the solar system would have brought within our range much fuller information respecting the other planets, and in particular the planet Mars, than we are ever likely to possess. Astrologers claimed such perfection for the principles of their art, that the whole history of our earth might have been predicted from the planetary configurations alone; and indeed they were very successful in showing that all past events corresponded with the aspect of the heavens when they occurred. Now, if other planets thus influence the fortunes of our earth, which is itself one of the planets, it follows that each of the planets is in like manner influenced by the positions and motions of the rest. But these can be quite easily calculated. Therefore the fortunes of the inhabitants of every planet can be determined, and the entire past history of each planet can be read by terrestrial astronomers. Only one circumstance must be ascertained telescopically. (At least so it appears to us, for we confess we are not such adepts in the methods of astrological divination as to be quite sure whether astrological principles, properly applied, might not have determined everything which the telescope has revealed. As a mere matter of fact, astrology discovered nothing of this kind. But that is the merest detail.) It should be known how a planet is posed in space, what are the pole-stars of its northern and southern hemispheres, and at what rate exactly it rotates upon its axis. For the astrologer, in determining the future fortunes of his "native," or in calculating the native's past history, has to take into account the aspect of the star-sphere at the moment of the native's birth, as well as at the critical stages of his career; and to do this properly account must be taken, of course, of the hour and of the position of the pole of the heavens.

We do, however, know fairly well the position of the axis of Mars, and we know the length of his day within the tenth part of a second, so that if only astrology were a sound method of divination, we might learn much of the past history and of the future fortunes of this planet. As De Morgan has remarked in an article on astrology in the "Penny Cyclopædia," "we have lost," in the rejection of astrology, "a charming opportunity of discovering what goes on in other planets."

The astronomer who watches, during the approaching close approach of Mars, the slowly-rotating lands and seas of the planet, can scarcely,

however unimaginative he may be (and we fear it is an essential requisite of the surveying astronomer that he should be as free from imagination as a man well can be), avoid the thought that contests such as have raged upon our earth for the possession of various regions of our planet's surface, may be in progress out yonder in space. Armies may be desolating the fairest regions of Mars at the very time when they are under the telescopic survey of the terrestrial observer. Warlike fleets may be urging their way across those seas and straits which our astronomers have marked down in their charts of the planet. We may hope, if we choose to forget our own experience of "Nature red in tooth and claw with ravine," that, in yonder peaceful-looking world, there is peace among all creatures. But our own earth, amid the fiercest tumults and the most desolating wars, presents to the other worlds that people space the same peaceful scene. Distance lends so much, at least, of enchantment to the view. The sun himself, over every square mile of whose surface turmoil and uproar prevail compared with which the crash of the thunderbolt is as silence, and the fiercest blast of the hurricane as absolute rest, looks calm and still in our skies, and even in the telescope shows signs of activity only to the mind's eye, none that our natural vision can appreciate.

It is a strange thought, too, that expeditions such as man makes to discover the hidden places of the earth may be in progress in other planets. Some among those lands and seas of Mars which the astronomer contemplates in the ease and quiet of his observatory may not as yet have been seen by inhabitants of Mars because of the dangers which prevent access to them. We may well doubt, for instance, whether the bravest and most enterprising Martialists have yet succeeded in reaching either pole of the planet. Our eyes have rested on those polar regions, even on the very poles themselves, of the planet. But so, an observer on Venus, possessing optical instruments of adequate power, could see, on turning them upon our earth, those terrestrial polar regions which the most daring of our voyagers have in vain attempted to reach. And, as the eyes of creatures in other worlds may thus have looked upon regions of the earth of which we know nothing from direct observation, so the eye of man has rested on the poles of a planet which is never at a less distance than 33,000,000 miles, while the inhabitants of that planet, if such there are, may have been foiled again and again in all attempts to penetrate within their polar fastnesses.

We wonder, in passing, whether the idea has ever occurred to the inhabitants of Mars that Martian regions have been made the subject of a war, and a somewhat lively war, though of words only, among terrestrial astronomers. Such has actually been the case, insomuch that if analogy may be our guide, astronomers in Mars and Venus are not improbably contending about the distribution of the four quarters of our earth, and our principal seas, and lakes, and islands, and peninsulas, among living and dead celebrities in those planets. The story of a recent short but sharp terrestrial war over the lands and seas of Mars is not without its lesson, even if that lesson be only a response to the time-worn question, "Tantæne animis cœlestibus iræ?" It would seem that an English student of astronomy who had found occasion often to refer to Martian regions until then unnamed, had for convenience assigned to these regions, after charting them (a work of some labor and difficulty), the names of those astronomers whose observations had thrown light upon the geography of the planet—or its areography, as, if pedantically inclined, we may name what corresponds with the geography of our earth. Thus to Sir W. Herschel one continent was assigned, to Secchi another, to Mädler a third, and to Dawes (the "eagle-eyed" observer to whom we owe the most exact observations of Mars yet made) a fourth. To divers other astronomers, all observers of the planet, various lands and seas were assigned. This was not done with the idea of honoring those astronomers, but simply of giving convenient names to features which have often to be referred to. A Belgian astronomer, Dr. Terby, of Louvain, who has laboriously examined and compared an immense number of pictures of Mars, adopted the nomenclature just referred to, adding one or two names (including that of the author of the English chart), but making no changes. Unfortunately, however, he had somewhat misapprehended the object of the names, and described them as "in honor of" such a one's labors, "in recognition of" the discoveries of such another, and so forth. This proved too much for the patience of a French writer on astronomy, who found neither continent nor ocean (as it chanced) assigned to any French observer, though large tracts of land and sea were given to Laplace, Leverrier, Arago, and other distinguished Frenchmen. He therefore incontinently reconstructed the chart, altering it in many respects (all the alterations, singularly enough, corresponding more or less closely with Dr. Terby's suggestions as

to what might have to be done when Mars was reëxamined). He called this chart his own, and proceeded to rename most of the lands and seas. He treated some English observers rather contemptuously, dismissing Sir J. Herschel altogether, relegating Dawes to a small sea, De la Rue to another, Lockyer to a third (all three seas close together). The most marked feature of all, a dark sea, shaped somewhat like an hour-glass, had been assigned to Kaiser, a German astronomer, who had made many interesting observations of the planet. M. Flammarion dismisses the German to a corner of that sea, and leaves the sea itself without any name except one descriptive of its shape—possibly intending that the name of a French writer on astronomy should fill the space.

On this Dr. Terby, of Louvain, rose indignant. In astronomic ire and areographic grief, he solemnly denounced the new nomenclature. To say truth, he had some reason to be annoyed, because his labors had been freely used with a form of acknowledgment which, though seemingly profuse, by no means did justice to his claims. "Nine times," said M. Flammarion, "does the name of Dr. Terby appear in my account of the lands and seas of Mars." "I would you had mentioned it once only," retorts Dr. Terby, "with the statement that the account is entirely taken from my labors," where it is not borrowed from the before-mentioned English astronomers. M. Flammarion promises, in return, never to mention Dr. Terby again. "*Mea culpa:* je ne le ferai plus," he says, adding, as a pleasant parting word, "à tout bien prendre cependant, il n'y a rien d'étonnant à ce qu'on se bataille à propos de Mars; espérons qu'il n'y aura pas de sang versé, et que la colère du petit lion Belge se calmera d'elle-même."

Let us turn, however, from these small bickerings to the consideration of the planet itself. Already in these pages[1] we have discussed two theories of the planet Mars regarded as another world. One is the theory that he is at present inhabited, and that too by creatures which, though they may differ very much from the inhabitants of this earth in shape and appearance, may yet be as high in the scale of living creatures. In particular this theory assumes as probable, if not certain, the belief that among the inhabitants of Mars there are creatures endowed with reason. According to the other theory, which we have called the Whewellite theory, Mars is altogether unfit to be the abode of creatures resembling those which inhabit our earth; neither vegetable nor animal forms known to us could exist on the planet; in fine, "all the conditions of life in Mars, all that tends to the comfort and well-being of Martian creatures, must differ utterly from what is human on earth." We have also in our essay on "Life past and future in other Worlds" (in the *Cornhill Magazine* for June, 1875) considered a general theory which in our opinion is far more probable than either the Brewsterian or the Whewellite—the theory, namely, that each planet has a life-bearing stage, but that the duration of this stage of its existence, though measurable perhaps by hundreds of millions of years, is yet exceedingly short by comparison with the duration of the preceding stage of preparation and the sequent stage of decay and death. From the direct application of the laws of probability to this theory, the chances are shown to be very small indeed that life exists at this present time on any planet selected at random and without reference to what observation has revealed. Precisely as, when we know that a bag contains several thousand black balls and only a few white ones, the chance that a ball taken at random is a white one is exceedingly small: so, the period of a planet's fitness for life being short compared with the preceding and following stages, the chances are very small that this present time, which is, so far as other planets are concerned, taken at random, falls within the period of any given planet's fitness to be the abode of living creatures. The telescope and the spectroscope may correct this inference, just as on looking at a ball taken from such a bag as we have described the drawer of the ball might find to his surprise that he had taken one of the white ones, few though they were compared with the black ones. But *apart* from such observations, the chances must be regarded as exceedingly small (according to this theory) that any given planet is at this present time inhabited. Nevertheless, two conclusions, according well with ordinary conceptions as to the fitness of things, follow from this theory: 1. Our earth is but one among many millions of worlds inhabited at this present time; 2. Every planet is at some time or other, and for a very long period, the abode of life. These three points—the small probability (apart from telescopic observation) that any given planet is inhabited now; the great probability that many millions (out of thousands of millions of planets) are inhabited now; and the equally great probability that every planet

[1] *See Cornhill Magazine* for May, 1871, "Life in Mars;" and for July, 1873, "A Whewellite Essay on Mars."

has been, is, or will be, inhabited—are demonstrated in the third of the essays above mentioned. That essay presents the view toward which the present writer had been gradually led—from the Brewsterian theory which he accepted until 1871, through the Whewellite, toward which he had inclined until 1873, when finally the intermediate theory seemed pressed upon him by overwhelming weight of testimony.

Our present purpose is to show more particularly how this theory accords with what is known respecting the planet Mars. We wish also to show how both the lines of reasoning which had been before employed, one pointing to the Brewsterian theory, the other to the Whewellite theory, converge in the case of Mars upon this intermediate theory.

In the first place, we saw, in considering the conditions which favor belief in the existence of life in the planet Mars, that he presents the clearest possible evidence of being one in origin and structure with our own earth. We cannot tell what the nature of the soil of Mars may be, but its generally ruddy tinge—so well marked that, though the telescope shows an almost equal part of the surface to be greenish in hue, the red prevails, giving to the planet as seen by the naked eye its obvious red color—seems to show that it resembles the red sandstone of our own earth. This, we know, is one of the older geological formations, and if we could safely compare terrestrial with Martian geology, or, let us say, geology with areology, we might almost be tempted to find in the present prevalence of a tint belonging to one of the earlier of our terrestrial formations an argument in favor of the theory that Mars passed through fewer stages of development during its life-bearing condition than our earth, and that thus the later formations of our earth's surface are wanting in the surface of Mars. This reasoning would not be very safe, however; it implies a resemblance in details which is unlikely, the observed rule of Nature seeming, so far as we can judge, to be similarity in generals, variety in details. We may well believe that the ruddiness of the soil of Mars is due to the same general cause as the ruddiness of our red sandstone—the general prevalence of certain organisms; but neither the actual character of this particular formation, nor its position in the terrestrial series of strata, can be safely predicated of the ruddy formation constituting the chief part of the visible land-surface of Mars. Few will now suppose with a French writer, that the ruddiness of Mars is due to the color of vegetation there. A certain support is given to the idea by the circumstance that the degree of ruddiness is variable, and is somewhat greater during the Martian summer than in spring and autumn. In this sense, we may say of the summer of Mars with the poet Wendell Holmes:

> "The snows that glittered on the disk of Mars
> Have melted, and the planet's fiery orb
> Rolls in the crimson summer of its year."

But the ruddiness of the planet's summer—which will be well marked this year, for on September 18th, only eleven days after its time of nearest approach and greatest splendor, it will be midsummer's day for the southern half of Mars—can be otherwise and better explained than by supposing that the Martian forests glow with fiery foliage during the summer days. We can see, as the summer proceeds, the white mists which had hidden the planet's lands and seas breaking up, and the features of the surface being gradually revealed with more and more distinctness. It is to the disappearance of these mists and clouds, not to the red leaves of Martian trees, that the change in the planet's color must most probably be referred.

We have less reason for doubt as to the nature of the greenish markings. The spectroscope, as we have already explained in "Life in Mars," shows that the air of Mars is at times laden heavily with the vapor of water. We can no longer, therefore, follow Whewell in doubting the real nature of the green parts of the planet, or refuse with him to accept the explanation of the white polar markings long since advanced by Sir W. Herschel. Undoubtedly wide seas and oceans, with many straits, and bays, and inland seas, exist on Mars. Snow and ice gather in the winter-time about his polar regions, diminishing gradually in extent as summer proceeds, but never entirely disappearing.

Thus we are not left doubtful as to the general resemblance of Mars, so far as the structure of his surface is concerned, to the earth on which we live. He has a surface of earth, probably in large part formed by deposition at the bottom of former seas and subsequently raised above the sea-level by subterranean forces, or rather caused to appear above the surface by the effects of the gradual shrinkage of the planet's crust. Of the existence of Vulcanian energy we have unmistakable evidence in the fact that lands and seas exist, for a continent implies the operation of Vulcanian forces. The shapes, too, of the outlines of the lands and seas indicate the existence of mountain-ranges, and these, too, of consider-

able elevation. Then we have the presence of water, and of a stable atmosphere in which the vapor of water rises. It seems no daring assumption to suppose that this air is constituted much like our own air. In the first place, if the air were formed of other gases, the spectroscope would probably reveal their existence, which has not happened; and, secondly, with the evidence we have of a general similarity of structure and origin, an atmosphere of nitrogen and oxygen would naturally be formed while the planet was developing to its present condition, and would remain after other constituents of the planet's primeval atmosphere had been removed. For a similar reason we may safely infer that the greenish hue of the water implies the presence of the same substances, though not perhaps similarly proportioned, which are carried in suspension in our oceans, and give to them their green, green-blue, and blue tints.

It is important to notice these general resemblances, either demonstrated or safely to be inferred. We no longer propose to deduce from them the conclusion that the planet's present condition is like that of our own earth. We might, indeed, dwell on some considerations which naturally suggest themselves here. We might see in imagination the waves of those distant seas beating upon the long shore-lines, and hear "the scream of a maddened beach dragged down by the wave." We can imagine the slow progress of the Martian day—the mists of morning gradually clearing away as the sun rises; the winds raised by the mid-day heat, zephyrs murmuring among the distant hills or blasts roaring loudly over desolate rock-bound seas; the gathering of clouds toward eventide, though probably to pass from the skies at night (because condensed by cold), leaving the same constellations we see to shine with greater splendor through a rarer atmosphere. We can imagine all this, because we know from what the telescope has revealed that such must be the changes of the Martian day. We see in the telescope the long, white shore-lines, the clearing mists of morning, the gathering mists of night, and we know that there must be air-currents in an atmosphere undergoing such changes. There must be rain, and snow, and hail, and electrical disturbances—thunder and lightning at times—besides tornadoes and hurricanes, blowing probably more fiercely than our own, though their destructive effects must be less because of the greater tenuity of the Martian air.

But while we recognize in imagination the progress of such events as these, we must not forget that for countless ages in the past mighty processes of disturbance and continuous processes of steady change took place in our earth when as yet there was no life, nor that probably life will have ceased to exist on this earth millions of years before the land, and sea, and air, will cease to be the scene of Nature's active but unconscious workings. We cannot deduce from the mere fact that, if living creatures existed on Mars they would witness such-and-such phenomena which are familiar to the inhabitants of earth, the conclusion that such creatures do exist there. We do not assert that no such creatures exist there. Our theory of life in other worlds does not require that any given planet should be shown to be uninhabited. Nevertheless, there are so many reasons for regarding the fullness of Mars's life-bearing season as belonging to a very remote past, that it is necessary to note the insufficiency of the mere evidence of the activity of Nature's unconscious forces to prove the existence of living, conscious beings on the planet.

In fine, the arguments by which, in the essay on "Life in Mars," we endeavored to indicate the probability of the planet's being inhabited, prove only that the planet had an origin like our earth's, and is similarly constituted.

On the other hand, the arguments by which, in the essay entitled "A Whewellite Theory of Mars," we endeavored to show that Mars is not in a condition fit to be the abode of life, tend to show that while similar to the earth in origin and structure, Mars is in a far later stage of planetary development.

One of these arguments, indeed, does not relate to the condition of the planet itself, but to its position with reference to the sun. Being much farther from the sun than we are, the planet receives much less direct heat. The supply is partly dependent, however, on the planet's condition; for, if the air of Mars is very rare, then apart from the diminished supply there is a more rapid cooling, owing to the readier radiation of heat into space. But in any case the supply of solar heat has to be considered as one of the factors of a planet's condition, considered with reference to the question of habitability. If, through its inherent heat, the planet Mars was once as warm on the whole as the earth now is, that heat making up for the smaller supply of solar heat, then it seems reasonable to believe that the creatures inhabiting the planet were so far like those now existing on our earth that the

same degree of heat suited their requirements. If, then, we find reason for believing that *now* the inherent heat of the planet is much less than that of our own earth, so that on this account the descendants of those creatures would be unable to exist unless great modifications had taken place in their requirements, which modifications seem outside any effects which could be attributed to natural selection, then the inference that therefore these races of creatures have died out is certainly strengthened, and in no small degree, by the fact that the supply of heat received from the sun is much smaller in the case of Mars than in the case of our earth. Seeing, then, that the average daily supply of light and heat on Mars (taking square mile for square mile of his surface) is less than the average daily supply on our earth in the proportion of two to five, we have here a strong argument, we will not say in favor of the belief that Mars is not now inhabited, but in favor of the belief that the duration of the life-supporting era has been, is, or will be, much more rapidly shortened than in our earth's case, by the cooling of his globe. For the life-destroying influence of the cooling is much more effectively strengthened in his case than in our earth's, by the effect of distance from the central source of light and heat.

All the other circumstances in the condition of Mars point directly to the conclusion that Mars must have long since passed his planetary prime. His orbit being outside the earth's, he was probably formed far earlier, though this is not so certain as it was held to be when Laplace's nebular theory was first advanced. It is, however, very unlikely that he began to be formed later; and, as he is much smaller, he would probably be fashioned more quickly. It is still more probable, in fact very much more probable, that he cooled much more quickly than the earth. His mass is not much more than a ninth of hers, while his surface is only about one-third of hers. He had, then, originally, even if of the same temperature when first formed, only one-ninth her amount of heat to distribute, so that if he had radiated away at one-ninth of her rate, the supply would have lasted as long. Pouring it away at one-third of her rate—for the radiation taking place from the surface is proportional to the surface—he parted with it three times faster than he should have done in order to cool at the same rate as the earth. Hence he cooled three times faster than the earth, and must have attained a condition which she will not attain until three times as long an interval has elapsed from the era of her first existence, than has already elapsed. Since most geologists assign many hundred millions of years to the last-named period, and all agree that it must be measured by many millions of years, it follows that twice as many hundred millions of years must elapse if the former are right, but only twice as many millions of years if the latter are right, before our earth will be in the same condition as Mars. In reality our argument is not at all affected by the difference of opinion among geologists in this respect. For the question is of the condition of Mars, not of the number of years which may have elapsed since he was in the same condition as our earth, or of the number of years which may have to pass before our earth will be in the same condition as Mars. Whether Mars requires hundreds of millions, or millions, or only thousands of years, to pass through one stage of its planetary existence, our earth requires about three times as long; and, taking the entire development of Mars and the earth (assuming they began planetary existence together), Mars must be some three times as far on the way toward planetary decrepitude and death as our earth.

Only one circumstance in the discussions of geologists on the question of the time required for the development of a globe like our earth, bears very strongly on our opinion as to the existence of life on Mars. It is not altogether certain that the life-bearing era of a planet is exceedingly short compared with the era of growth and preparation, and the era of decrepitude and death. So far, indeed, as astronomical considerations are concerned, we perceive that the fashioning of a planet must be a process requiring an enormous length of time. The slow aggregation of nebulous matter, the separation of ring from ring, the breaking up of a ring into separate nebulous masses, and the gathering of each ring of them into a single mass, must have proceeded very slowly; and few who consider all the circumstances of the case will doubt that hundreds of millions of years must have elapsed between the time when first the matter of a future planet began to have separate existence, and when at length it was all gathered together in a single mass. But what followed—the gradual contraction and cooling of that mass till it became a true planet, the gradual cooling of the planet until its surface became separable into land and water, the further cooling till life became possible, the progression of life through all its various stages till earth and sea and air had each their various races of

living creatures—all these stages of the planet's existence belong to the domain of geology and biology, not to that of astronomy. Doubts have arisen respecting the duration of these eras, and as yet these doubts remain. Nor have biologists as yet determined how long life may be expected to continue upon our earth. Some see already the signs of what may be called biological decrepitude. It has been asserted that man, the highest race of living creatures which the earth has yet known, is not only the highest she will ever know, but that the race, regarded as a type of animal life, has already passed its prime, and has advanced perceptibly toward decadence.[1] Lower races, however, seem capable almost of indefinite multiplication—we refer, be it understood, to the multiplication of races, not of the individuals composing races. And so far as mere life is concerned, it would seem as though the earth might undergo vast changes of condition, and the sun himself lose largely in heat-emitting and light-emitting power, without the earth being depopulated, so long at least as the changes took place gradually. It may well be that life begins at so early a stage of planetary development and continues to so late a stage, that the entire duration of a planet's life-bearing era bears a much greater proportion to the entire duration of the planet than our reasoning (a few paragraphs back) implies.

But, after all, the question of mere life in other worlds is not what we are interested in. Mere consciousness can scarcely be regarded as a more interesting phase of Nature than unconscious activity such as we see in the vegetable world, or than the motion of inert matter, or even than the mere existence of matter. If we could be assured that Mars and Venus and Mercury are crowded with animal and vegetable life of those lower forms which owe their inferiority to decrepitude of the type, or that on the youthful planets Jupiter and Saturn some of the monstrous forms exist which flourished on the earth when she was young—

> ". . . . Dragons of the prime
> That tear each other in their slime,"

[1] One of the evidences for this discouraging conclusion, advanced by a well-known American zoölogist, is the relative length of the period of old age in the individual man. In youthful races, the individual does not attain old age till very soon (relatively to the entire life) before death. The relative duration of old age grows longer and longer as the race grows older, until, in races which are about to pass away, it becomes nearly equal to half the entire interval between birth and death, soon after which the race dies out.

what to us would be those teeming worlds of life? They might as well be mere inert masses circling idly round the sun, neither now nor ever in the past the abode of life, and never to become so in future ages. The story of such life would be to us as—

> ". . . . A tale
> Told by an idiot, full of sound and fury
> Signifying nothing."

It is the existence of intelligent beings on those remote worlds that alone has any interest for us, the thought that the wonders of the universe are recognized by beings in some sort like ourselves, that the problems which perplex us may have been dealt with, perchance even solved, by others, and again that our world may be a subject of interest and study for creatures thinking as much, but knowing as little, about us as we think and know about them.

In this respect certainly, if analogy can be any guide at all, we find little reason for regarding with present interest either the younger giant planets, Jupiter and Saturn, or the probably aged dwarfs, Mercury, Mars, and our moon. Few believe that men have existed on the earth many hundreds of thousands of years, and those even who assign to the human race its greatest duration in the past, regard it in its earliest form as little better than a race of brute beings. If we supposed that men sufficiently intelligent to consider the heavens and the earth have existed in our world for one hundred thousand years, we are certainly giving the widest possible allowance of duration to intelligent man. Nor can it be denied that the existence of such a race as ours seems far more definitely limited in the future by the slowly-changing condition of our earth and the life-giving sun, than that of lower types of animal existence. We would not assert that beyond all question a hundred thousand years hence the earth will no longer be a fit abode for man, who has already begun to draw very largely on the garnered stores of our globe; but we consider this view altogether probable, and that indeed a nearer limit might be assigned to the duration of the human race, by one who should carefully consider the progress and requirements of the race on the one hand, and the condition, changes of condition, and capabilities of our earth, on the other.

If we assign 200,000 years as the extreme duration of the period during which men capable of observing the phenomena surrounding them and of studying the problems of the universe have existed and will exist, we assign

to our earth a reason-life (if we may so speak) which, compared with the full life of the earth, is but as a second compared with centuries. So far as the existence of beings capable of thought and reflection is concerned, our theory assuredly holds. It is on *a priori* grounds utterly unlikely that any one of the orbs we can actually observe is inhabited by creatures like ourselves in those circumstances which distinguish us from the brutes and from savages.

So far as observation extends, in the case of Mars, it seems altogether unlikely that the present era of his existence corresponds with that very brief period during which reasoning creatures inhabit a planet. Supposing we have rightly taken 200,000 years for the duration of that period in our earth's case—and it seems far more likely that the estimate errs in excess than in defect—the duration of the corresponding period in the case of Mars would probably be about 70,000 years. Mars would probably have entered on that stage of his existence millions of years ago; but, supposing for a moment that he reached it at about the same time as our earth, or, according to our estimate, a hundred thousand years ago, then the period would have been completed about 30,000 years ago. The appearance of the planet implies a much later stage, however, of planetary existence. The seas of Mars present all the appearance of exhaustion during millions of years, in the course of which their waters have nourished the surface of the planet with rain. The water thus raised from the Martian oceans has no doubt been always restored to them in large part, either falling directly on the water-surface in rain, or being gathered by streams and rivulets and rivers on the land-surface, to be discharged by the river-mouths into the seas. But a portion has always been retained by the land, soaking slowly and steadily into the interior of the planet. This portion has doubtless been exceedingly small each year, but during the long ages which have elapsed since first the seas of Mars had separate existence, the total amount thus drained off must have been enormous. We see the effect in the relatively small area of the Martian seas. They cover barely half of the planet, while terrestrial seas occupy nearly three-fourths of the surface of our globe. They have the shape also which our seas would have, if somewhat more than two-thirds of the water were dried up. The variety of tint which they present shows that but few of those seas are deep, for few of them are dark. Many are so light as to suggest the idea that a large part of the area shown in the charts as aqueous consists in reality of land and water so broken up into small islands, lakes, straits, isthmuses, and the rest, that the telescope cannot distinguish the details. Again, the unchanging color of the land-regions implies that they are naked and sterile. Unless we adopt the theory that not only is the vegetation of Mars rubescent, but that all the principal glories of the Martian forests are ever-reds, and the Martian fields covered with herbage of unchanging ruddiness, we must accept the conclusion that the land-surface is an arid desert. This evidence alone is almost strong enough to assure us that none but the lowest forms of life—animal and vegetable—exist on Mars at present. The evidence against the fitness of Mars to support the higher forms of life seems overwhelmingly strong.

But, after all, why should a conclusion such as this dishearten the student of other worlds than ours? Whether it relates to a planet here and there, to Mars or Mercury, or the moon, because of their decrepitude, or to Jupiter and Saturn because they are as yet too young, or whether it is extended according to the laws of probability to the universe of planets, does it not accord with what we know of our own earth? We do not mean merely that our earth as a planet was once unfit, and will one day become again unfit, to support life; but that even during the present life-supporting era of its existence we do not find all regions of the earth at all times fit to support life; nor do we find all races existing simultaneously. As various races begin, develop, and die out, as various regions are at one time sterile, at another clothed with life, so among the orbs inhabiting space, now one set of races may exist and anon an entirely different set, the series of planets which during one era are the abode of life being the nascent worlds of a former, the dead-worlds of a later era. A modern believer in the universality of life says: "On those worlds, as on ours, there are cities passing through all the stages of glory and of power; there also, as here, there are cities like Rome, and Paris, and London, altars and thrones, temples and palaces, wealth and misery, splendors and ruins. And, perchance, from the venerable ruins of an ancient capital two lovers at this moment on the planet Mars may be gazing on the traces of the grandeur and of the decay of empires, and feeling that amid all the metamorphoses of time and space, life, eternally young, pervades the universe, reigning forever over all the worlds, and pouring forth endless youth in

the golden rays of all the suns which people infinity." But the very scene which suggested these ideas should have taught another lesson. Not every region of earth is inhabited, not every inhabited region is a Rome, or an Athens, or a Paris, or a London. While some great nation or city is enjoying the fullness of its vigor, others are perishing or have long since passed away, others are as yet unknown, or but begin their existence. So may it well be, so *must* it be if analogy is our guide; so *is* it if our observations can be trusted, with other planets than this earth, with other systems than our sun's. As each orb occupies but the minutest portion of the infinity of space, so is the lifetime of each but a wavelet in the ocean of eternity. Two wavelets, or many, may run side by side upon an endless sea, and so may the lifetime of our earth synchronize with life upon another world, or many others. But for each wave that thus runs beside the wave of life on which our lot is cast, a myriad—nay, ten million million others—are far removed from ours, lie even beyond the horizon bounding what we call time. The universe, as we know it, the region of space to which our most powerful telescopes penetrate, is not more utterly lost in the true universe of infinity than is the range of time, past, present, and to come, over which our researches extend, amid the infinities of time eternal.—*Cornhill Magazine.*

A NEEDED RECONSTRUCTION OF THE NEBULAR HYPOTHESIS.[1]

By CARL DU PREL.

"Si les phénomènes ne sont pas enchainés les uns aux autres, il n'y a pas de philosophie." [2]—DIDEROT.

EVERY sense-impression takes a certain time to reach the consciousness, the length of time varying with the force of the impression and the sensibility of the individual. If with the physiologists we take the mean length of this interval to be one-sixth of a second, it becomes evident that in very rapidly reading print there is not time sufficient for each letter of every separate word to make its due impression. Were this not so, the task of discovering printers' errors would be far easier than it really is, even when we peruse a printed page with that one object in view. Since, however, we apprehend the meaning of what is read, fast reading must be more or less *guessing*, inasmuch as we fill in from our own resources the missing impressions, and from a few letters infer the whole word. Reading, therefore, is more or less a synthetic function of the human mind, and the greater one's power of synthesis, the greater (all other things being equal) will be his power of reading rapidly. Undoubtedly we are aided here by the fact that all the words in a sentence cohere to produce an intelligible impression, and under such circumstances we infer a word much more readily than we could if it stood alone.

In reading the book of Nature we exercise a like synthetic function of the mind. Inasmuch as we are ignorant of the causal relations subsisting between multitudes of natural phenomena, this book is for us, as it were, resolved into its words and letters; indeed, no small portion of the contents of the book is altogether unknown to us. It is for the investigator of Nature, in the narrower sense of the term, to analyze and explore with all possible minuteness individual phenomena; but he takes rank among philosophers when he goes further and strives to class together those phenomena which are united by the invisible bond of the law of causality. Herein he must depend on his faculty of synthesis for the power of detecting the proximate or remote, the direct or collateral relations of phenomena. Often, however, this can only be done by filling up the gaps in our knowledge, just as in reading we fill up the gaps in the series of sense-impressions, and by inferring the existence of phenomena that we have never seen. Thus do we construct words, sentences, chapters, of the book of Nature out of the defective series of phenomena given us in experience.

In a greater or less degree all branches of natural science have already entered on that phase wherein further development depends on the synthetic faculty, and the human mind will

[1] Translated from the German by J. Fitzgerald, A. M.

[2] "Unless phenomena are linked together, there is no philosophy."

have reached its perhaps unattainable goal only when it has succeeded in combining the multitude of its conceptions in a comprehensible scheme of the universe. We must not, however, forget that even then only one chapter of the great book of Nature would have been made out; we should still have to give ourselves an account of the past and future history of the Cosmos.

If truth in this sense is to be defined as the agreement of our ideas with the things they represent, then the discovery of truth would appear to be a process of thought in which the members of the subjective series are connected together in a manner answering to the connection between the members of the objective series. The subjective association must conform to the objective.

To this synthesis do all those great hypotheses owe their origin which have made their mark in the history of the human mind.

The greater the abundance of the empirical material developed by research, the easier it is to make this synthesis. Nevertheless, great discoveries do not by any means always coincide with periods of active and fruitful research, nor is Zimmermann's saying always true, that "the more the eyes have seen, the more does the mind see too." Indeed, it very often happens that in such periods we cannot see the forest, for the trees; while in other periods genius anticipates, using a relatively small sum of empiric data with the utmost economy, on them basing hypotheses which later, when the sum of confirmatory phenomena has been much increased, find universal acceptance. Such efforts as these at synthetically combining individual phenomena whose relations are not yet ascertained, and from the aggregate of the phenomena constructing the organism, so to speak, of the universe, thus rendering it intelligible, might be compared to the task of reconstructing, out of some disconnected words that still remain, the text of a badly-mutilated document.

No essay of this kind is so well calculated to excite our admiration as that of Kant in constructing, out of the at best extremely scanty materials at his command, the history of that little cosmical island which we call the solar system.

For what did Kant know of that system? If we leave out of view the comets, which he did not take into account, Kant was acquainted with six principal planets and nine moons: he knew that these bodies revolve round the sun, in one and the same direction; that Saturn has rings; that the orbits of the planets are approximately circular, and that their orbital planes nearly coincide.

What do we know of the same subject? Not only has the number of the planets (the asteroids included) increased to one hundred and sixty-four since Kant's time, that of the moons has increased to eighteen, and all these bodies give confirmation to the nebular hypothesis. Further, we are acquainted with Plateau's interesting experiment in which he imitated in miniature the genesis of the solar system by causing a sphere of olive-oil to rotate in a mixture of water and spirits of wine, and thus from the standpoint of the universality of terrestrial laws demonstrated the correctness of the Kantian hypothesis. Again, we know of the existence of cosmic nebulæ—the primordial matter inferred by Kant—the gaseous constitution of which is demonstrated by the spectroscope: nay, even the telescope enables us to descry gaseous rings, analogous to the rings of Saturn, encircling the cosmic nebulæ. Finally, a number of variable and of new stars have been discovered. All of these bodies are, as it were, words that were altogether wanting in the text examined by Kant, but which can be of very great service to us in writing the history of the Cosmos: hence, it is no wonder if in the nebular hypothesis we recognize a degree of probability very closely bordering on certitude. But it is a thing worthy of all admiration that in the mind of the philosopher of Königsberg there should have been formed a train of ideas whose agreement with a train of long-past phenomena could at the time be demonstrated only at a few points, but into which all the discoveries since made fit with perfect ease, like the links of a chain.

Kant was very far from believing that by this hypothesis he had done away with the need of further research; but it almost looks as though we, in our zeal to add to the material confirmatory of the nebular hypothesis, had forgotten to note the gaps in it that no discovery can fill, and the defects under which it still indisputably labors. And yet in the materials accessible to Kant there is to be found, as we shall see, that which should incite us to a reconstruction of the hypothesis. We are collecting building stones, without reflecting that, in proportion as materials accumulate, the edifice should rise. We make that an end which is but a means; but, since in the Cosmos all phenomena are systematically connected with one another, it cannot be our task simply to accumulate them in our minds in disconnected shape: on the contrary, in our mental

scheme of the universe the whole must be systematically combined.

Kant, and, less thoroughly, Laplace, have drawn the main outlines of the process by which the solar system came into existence, and according to which the properties common to the planets and moons are to be accounted for. The theory, however, does not explain the differences existing between those bodies with respect to mass, distance from the sun—which, according to the well-known law of Titius, is approximately a geometrical progression—form of their orbits, and velocity of their motion. And yet it is precisely on these differences, but particularly on the distribution of the mass through space, that the stability of the system rests. Hence we have still to account, on the basis of natural laws, for the teleological result of the process. Either we must attribute to primordial matter, in addition to gravity, some other property which shall explain the teleological result, or else we must assume an important corollary of the principle of gravity to have been overlooked by Kant. This latter assumption is the only one that is scientific.

We have, therefore, to reconstruct the nebular hypothesis on the basis of the law of gravitation, and to solve the following problems:

1. The teleological mass-distribution of the planets must be accounted for. It is not enough to say that the sun contracted and gave off equatorial rings; for the main point to be considered is the fact that, at such and such distances from the sun, planets of a certain proportionate velocity and mass hold their courses, and that no change could be made in any of these factors without causing perturbations.

2. Comets and meteorites must be brought within the purview of the nebular hypothesis, and their great numerical superiority over the planets must be shown to be a necessary consequence of the law of gravitation. When Laplace writes,[1] "Dans notre hypothèse les comètes sont étrangères au système planetaire," without citing any evidence to show that they are in reality of extraneous origin, he appears simply to confess his perplexity; nor is it permissible to eliminate the comets by arbitrarily assuming them all, both those traveling in the same direction with the planets, and those traveling in the reverse direction, to have descended only at a later period into our system from the regions of the fixed stars, to say nothing of the fact that by such assumption we do but push the problem farther back.

3. We have to explain why, notwithstanding the enormous expansion of the primordial solar sphere, the planets are not more numerous than they are; and further, why they are attended by their actual number of planets, and neither by more nor less. That we are warranted to propose this question is plain, especially from the fact that the number of moons accompanying a planet is, as a rule, though with exceptions, in a ratio to that planet's rotation velocity. Astronomy is only a branch of mechanics; and hence, when we see, for instance, that though Mars rotates with nearly as high velocity as the earth, it is nevertheless moonless, we must directly conclude that the moon of Mars, theoretically existent in accordance with mechanical principles, must at one time have existed in reality.

As must always be done with phenomena which, standing alone, are barren, we have now to connect synthetically these three groups of phenomena, which of necessity must be more or less closely related to one another.

That Mars's moon is wanting is a fact that by itself says nothing, but it becomes very eloquent when we connect it with the two other points of the problem we have to solve. In the first place, when we consider that in the formation process of the solar system processes of elimination, too, had a place, it appears allowable to assume elimination of once-existent satelilites. And if now we view these processes of elimination in connection with the phenomena spoken of in section one, the two are found to throw light on each other, and we are inevitably led to conclude that the teleological distribution of mass in the solar system is the result of processes of elimination whereby those planets and moons have been displaced, which deranged the mechanism of the system.

Not only does this explanation deduce from the law of gravitation the teleological phenomena of the solar system, it furthermore proves itself to be the only just explanation by its conformity to the laws of logic, which require us to look on such phenomena not as entering Nature already fashioned and shaped, but as being the results of a process of development. And if science, which, as it has been supposed, spurns the idea of teleology, would nevertheless demonstrate the possibility of teleological results, it can do so only by assuming a process of *indirect* selection; and this in turn is conditioned on the impossi-

[1] "Exposition du Système du Monde." p. 475. Paris, 1846.—"In our hypothesis the comets are extraneous to the planetary system."

bility of any unteleological (or unadapted) forms existing in a systematically-connected whole.

From this point of view the evolution of the Cosmos is seen to be, as indeed we should have expected, entirely analogous to the evolution of all the kingdoms of Nature. Just as in biology, for example, adaptation to environment is attained only indirectly through a weeding-out process, which consists in the elimination of organisms that are incapable of existing: so in the mechanism of the heavens does the law of gravitation, by indirect selection, work adaptation between the different members of a system, by eliminating such members as are inconsistent with the rest. The perturbations arising out of the mutual attraction of planets have indirectly—that is, by eliminating the greater part of the earlier *comites* of the sun—made selection of that small number of planets which now exist; and our present planets are able to continue in existence, in spite of their mutual gravitation, because of the incommensurability of their periodic times. Nature acts after the manner of the engraver on wood, who makes his engraving in relief only indirectly, by cutting away the face of the wood between his lines.

Cosmical problems are to be solved only by concluding from phenomena offered to us in experience to phenomena in the past. But now perturbations are familiar phenomena in the planetary system, and their only effects consist in diverting the planets a little out of their regular course. But that they might also exert the higher power attributed to them in the preceding paragraph—namely, the elimination of cosmic bodies from the system—we see from the comets, whose orbits not seldom are entirely transformed as the result of perturbations.

It has been demonstrated by Newton that, under the quadratic law of attraction, the tracks of the planets can only be conic sections with the point of attraction for focus, their forms being, according to the ratio of the force of gravity to the centrifugal force, circles, ellipses of different lengths, parabolas, or hyperbolas. Actual elimination of planetary bodies, therefore, could take place only on this relation of gravitation to centrifugal force being so materially altered that either, the force of gravitation having increased, a spiral motion toward the centre of attraction was set up, or else that, the centrifugal force having been considerably increased by perturbation, the original circular track was converted into a not-closed orbit, whether parabolic or hyperbolic. But all those planets whose tracks were converted only into elongated ellipses remained in the system.

Yet such planets do not exist. Only comets and meteorite-showers move in such elongated ellipses—that is to say, those very bodies which, as we have said, it is incumbent on us to embrace within the nebular hypothesis. But not only is it now certain that the meteorites are fragments that once belonged to great planetary bodies, but Schiaparelli has even demonstrated the connection between comets and meteorites; while, from Zöllner's researches it appears to be highly probable that comets are only meteorites of vaporizable matter.

It only remains, therefore, to prove that planetary bodies, which were by primordial perturbations forced into elongated orbits, must, in consequence, have progressed more rapidly toward disintegration than those which were forced only a little out of a circular track. In investigating this subject we shall derive material assistance from the comparative astronomy of the planetary system, since in our planets and moons, whose conditions represent various phases of a like process of development, the ultimate phase—that of the meteorite-showers—is already more or less plainly typified. But I will not discuss this point here, having considered it fully in another place.[1]

According to the nebular hypothesis, the matter constituting our system was at one time diffused beyond the orbit of Neptune; and it has been computed that matter so attenuated as this must have been could not have exceeded in density the ten-millionth part of the density of the lightest gas known—namely, hydrogen. Such enormous attenuation as this—an attenuation presupposing a development of heat that is hardly imaginable—is in itself enough to force us to the conclusion that there was at one time much more matter within the space circumscribed by Neptune's orbit than exists there now; and that, consequently, the primordial nebula was very, very much less attenuated than it was if the estimate above were correct. For this reason the meteor-streams and comets must be for us welcome phenomena; for if they once existed in interplanetary space in the state of dissolution, and passed beyond its limits only in consequence of later perturbations, then they must bear some

[1] *See* "Der Kampf ums Dasein am Himmel: Versuch einer Philosophie der Astronomie" ("The Struggle for Existence in the Heavens: An Attempt at a Philosophy of Astronomy").

analogy to the cosmical nebulæ revealed by the spectroscope. Further, we have to bear in mind that all those original *comites* of the sun which, forced into hyperbolic and parabolic tracks, have quit the system, must likewise be added in order to fill up the space circumscribed by Neptune's orbit. In this way we arrive at a leastwise conceivable degree of attenuation for the primordial matter of the solar system.

If we consider that the fixed stars, too, have their attendant planets; that in their systems the same process of elimination takes place; and that our sun receives from the neighboring fixed stars at least as many banished members of other systems as have been eliminated out of its own, it will be seen that we can only proximately and indirectly determine the number of the planetary bodies which have been dropped from our system.

Those comets and meteorites which travel in a retrograde direction are to be regarded as intruders from other systems. Some of these, under the action of planetary influences, have acquired closed orbits, and have settled for good within our system. As for the comets and meteorites with direct motion, though their elongated orbits do not prevent us from recognizing them as fragments of planets that once belonged to our system, we nevertheless have still to account for the fact that whereas the orbital planes of the planets are nearly coincident with the plane of the sun's equator, the orbits of many comets and meteorites form considerable angles with the plane of the earth's orbit. But this difficulty vanishes also when we regard this inclination toward the orbit of the earth as produced by perturbations. Thus, for example, Brorsen's comet of 1846, which, according to d'Arrest, in 1842, the attraction of Jupiter brought nearer to us, had to the earth's orbit an inclination of 41°, which was reduced to 31° by this single perturbation. Under suitable conditions, that angle might be increased to the same extent.

It is plain, therefore, that we can reach a *monistic* conception of the history of our solar system only by assuming indirect selection of the fittest and elimination of the unfit here as in every other province of Nature. In this way not only do we explain the teleological distribution of mass through the planetary system, but also obviate the necessity of having a separate theory each for planets and comets.

So must we supplement Kant and Laplace with Darwin.—*Kosmos.*

ON ICE-MAKING AND ICE-MACHINES.

By W. N. HARTLEY, F. R. S. E.

THE resolution of all forms of energy into heat, the continual passage of heat through solids, liquids, and gases, and its tendency to become equally distributed through all matter, are now recognized as facts; hence the inevitable conclusion that finally all substances in the solar system, if not in the universe, will ultimately arrive at one common temperature. Mechanical motion, electricity, chemical action, all other forms of energy which at present are sources of heat, will be completely exhausted. Man, by his use of machines, is hastening this end of all things, and this indeed by the production of low as well as of high temperatures.

An economical means of freezing water is a fruitful source of profit at the present time, for the manufacture of ice serves not only the purpose of enhancing our bodily comfort in summer, but also for rapidly cooling large volumes of liquid, as in the operation of brewing and other industrial processes, and for the better preservation of animal food in seasons and climates which hasten putrefactive changes.

The difficulty experienced in freezing water is due to the very large amount of heat it must lose: 1. In being lowered to the temperature of 32° Fahr.; and, 2. In being changed from liquid water at 32° Fahr. to solid ice at the same temperature. The first quantity is called its specific heat, and the second is its latent heat. These quantities are greater for water than for any other substance; hence the cooling power of ice is greater for any given temperature than that of any other body, and the cooling power of water is greater than that of any gas or liquid. Faraday calculated that the heat absorbed during the conversion of a cube of solid ice measuring three feet in the length of one side, into liquid water without undergoing any rise of temperature, would require the combustion of a bushel of coals for its artificial production.

It is evident from these statements that, in

order to cool a quantity of heated air or water down to a moderate temperature, a large supply of water is the best medium, not only on account of its abundance and cheapness, but because of its great capacity for heat.

When any elastic fluid is compressed, it becomes hot, and if it then be cooled down to its original temperature and be expanded, it is rendered as many degrees colder by its rarefaction as it was heated by its condensation; hence we have here a means of producing low temperatures. On the one hand we can ignite tinder by the heat evolved in the compression of air in a glass cylinder; and by the exhaustion of air in a bell jar the temperature may be reduced so that the moisture it contains is deposited as a mist. By the extremely rapid expansion of a liquefied gas when pressure is removed, or of a volatile liquid when its evaporation is hastened by mechanical means, we obtain the most effective cooling powers. The familiar experiment of freezing water or mercury in a red-hot dish is effected by the enormous expansion of liquefied sulphurous acid or of solidified carbonic acid, which substances regain the heat they lost when undergoing the change of liquefaction or solidification.

The production of intense cold by the rapid evaporation of ether projected in the form of a fine spray is a process which has been introduced with success into surgery by Dr. Richardson, for the purpose of producing a local insensibility to the pain caused by a knife or other instrument.

By inclosing ether in an air-tight vessel, and drawing off the vapor as fast as it is generated, evaporation is greatly accelerated, while the ether may be condensed again for further use. The original apparatus of Harrison, which depended upon this principle, consisted of a multitubular boiler immersed in an uncongealable liquid such as brine; an exhaust-pump carried off the ether-vapor which is rapidly formed at the expense of the warmth of the salt-water. The reduction of temperature may reach 24° Fahr., or what is commonly called 8° of frost. The ether was condensed by passing through a worm-tube surrounded by a stream of cold water, and the chilled brine was made to circulate round metallic vessels containing the water to be converted into ice.

Many improvements have been made on this ether-machine, and one of the most complete methods of working is now in operation on a large scale on the premises of the Manchester Patent Ice Company.

Messrs. Sidely and Mackay, of Liverpool, are the patentees of the apparatus, the chief characteristics of which are its adaptability to the satisfying of large demands, its economical use of the cooling power of the ether-vapor, and its capability of making ice in thick blocks. Not only are exhaust-pumps used for evaporating the ether in the refrigerator, but pressure is exerted to liquefy the ether in the condenser. Both refrigerator and condenser are tubular vessels. Now, as the vapor passes from the refrigerator to be condensed by the pump, it is made to part with some of its chilliness either to ether going to the refrigerator, or to water about to be frozen; and again in its return-passage to the refrigerator it is deprived of any oil which it may have acquired from the machinery. The whole of the cooling apparatus is below-ground, and contained for the most part in pits of cement or asphalt. The water to be frozen is run into metallic tanks, between the inner and outer surfaces of which chilled brine at a temperature of 15° Fahr., or 17° below freezing-point, is made to circulate, the metallic vessels being connected by stout vulcanized India-rubber tubing. The water during freezing is kept in constant agitation, with two objects—first, to remove air, and so obtain clear ice; and, second, to equalize the temperature throughout, so as to prevent the water freezing on the surface, as it ordinarily does on a pond. The ice is formed first round the sides of the cell, and gradually thickens till it closes up in the centre. The clearness of the ice is greatly increased by slow freezing, and to obtain this desirable condition the time allowed is from sixty to ninety hours. Each block of ice measures three and a half feet broad by four feet long, and is thirteen inches in thickness; the weight varies from six to seven hundred-weight. A simple contrivance to facilitate the removal of the ice by a crane traveling on rails laid on beams overhead, is a loop of rope which is frozen into each block. The ease with which, when placed on the ground, these large blocks can be slid about by the men is very advantageous. In order to loosen the ice from the cells, brine at any temperature above 32° Fahr. is made to circulate in place of the frigorific liquid, and so greatly are the metallic vessels cooled that it requires a period of about an hour to loosen one of the blocks.

The magnitude of the operations is such that the engines can be worked up to one-hundred-horse power, and are capable of turning out thirty tons of ice per day. On the occasion of a recent visit to this interesting factory there were one hundred and eighty tons of ice in store, and some

of the blocks were five weeks old. We have an apparent paradox in the fact that the combustion of one ton of coal in the furnace-fires will produce eight tons of ice.

In the last number[1] of the *Popular Science Review* it was found necessary to refer to the researches of Faraday and others on the liquefaction of gases, and of Prof. Andrews on the continuity of the liquid and gaseous states of matter; it is therefore of great interest to note how a purely scientific fact can in a most unexpected way be made available for industrial purposes. No one could have imagined that the liquefaction of gases could prove of any practical benefit to mankind, but we now know that such is the case, since M. Carré's ammonia freezing-machine depends upon the liquefaction of the gas by pressure, and its subsequent condensation in water after it has produced a low temperature by its evaporation. The operation is conducted without the application of any mechanical power. A hollow conical condenser of iron has a space between its inner and outer surfaces, which is connected by a tube with a boiler containing ordinary liquid ammonia; that is to say, a solution of about seven hundred volumes of ammoniacal gas in one volume of water. The conical condenser is immersed in a stream of cold water, while the boiler is heated over a fire or large gas-burner to a temperature of 270° Fahr. During this operation the ammoniacal gas is expelled from the water, and is condensed by the pressure of its own particles and the cooling action of the stream of water. If, now, fresh cold water be placed in the condenser-cone, and the heated boiler be cooled in water, the ammonia distills off at the expense of the heat in the water to be frozen, and finds its way back once more to the boiler, ready for another operation.

Leslie's famous experiment of causing water to be frozen by the rapid absorption of heat caused by its own evaporation has been modified by M. Carré, in such a manner that ice in small quantities, as, for instance, in water-bottles, may be made in a few minutes. The apparatus consists of an air-pump, to which the water-bottle is attached. As the handle of the pump is worked and the air exhausted, a quantity of oil of vitriol is agitated in a vessel, through which all aqueous vapor and air from the water-bottle must be drawn. The avidity with which the oil of vitriol absorbs the vapor as fast as it is formed so hastens the evaporation that in a few minutes a bottle of ice is the result.

[1] *See* "Mineral Cavities and their Contents."

Perhaps, of all machines, the one of most interest is that invented by M. Raoul Pictet, of Geneva, the striking feature in which is the employment of liquefied sulphurous acid as the absorbent of heat instead of ether. In all other machines there is a liability to a slight leakage, on account of the fact that the cylinder of the exhausting and condensing pump is kept air-tight to some extent by the lubricating material. Now, as ether and all kinds of grease are solvents of each other, it is easy to account for a certain amount of escape, which will be difficult to avoid. Liquefied sulphurous acid does not dissolve to any considerable extent in oil, and when free from moisture is without action on metals; and, although it might be expected that the packing of the piston might in time be acted on by sulphurous acid, yet this danger has been entirely obviated by the use of manufactured asbestos-packing, which is now being greatly used for high-pressure steam-engines.

When required to work in hot climates, the ice-making machines most generally in use are open to serious objections, and grave inconveniences are experienced in their constant employment. Thus, ammoniacal machines work at a pressure of twenty atmospheres, with water at 80° Fahr., and are thus liable to leakage, or even to the danger of an explosion. Methylated ether machines are open to the same objection, in addition to which there is a danger of fire when a leakage occurs, which unfits them for use at sea.

Now, in the use of sulphurous acid there is the great advantage that at 80° Fahr. its tension does not exceed four atmospheres, while it may be liquefied at 25°, and its tension then is only equal to the pressure of the atmosphere. It has no action upon metals when kept free from water; and, in order to obtain it in a perfectly anhydrous condition, M. Pictet prepares it by the action of heat on a mixture of oil of vitriol and sulphur, the gas being dried by oil of vitriol. The condensing and refrigerating apparatus consists of tubular vessels similar to those employed with other liquids, such as ether.

One of these machines is daily at work at the Chelsea Ice-Rink, and is capable of making forty tons of ice per day. The skating-floor, which is the invention of Mr. John Gamgee, consists of a number of flattened metallic tubes placed side by side on a bed of concrete or asphalt; the interior of the tubes is kept filled with an uncongealable mixture of glycerine and water, which is allowed to flow in from an elevated cistern. Clear ice is secured by coating the tubes with water-

spray, allowing this to freeze, and then sprinkling again. During last winter, tubes of thin sheet-iron were laid on the floating-bath on the Thames, at Charing Cross, and a skating-floor was frozen. The temperature of an ice-rink, from its agreeable coolness, has an exhilarating and bracing influence, which dissipates the languor felt in a warm, moist atmosphere.

M. Pictet's machine has interest beyond that of any ordinary, economical producer of ice, for, constructed as it is with all the philosophical thought and scientific knowledge which we usually find bestowed only on instruments of research, it has been applied by its inventor to the purpose of establishing certain simple relations between the latent heat, molecular weights, and tensions of the vapors of volatile liquids.

By the application of mathematical reasoning and the use of known data, M. Pictet calculates the latent heat of various liquids, and arrives at the following conclusions:

1. Cohesion is a constant quantity for all liquids.

2. The derivate of the Napierian logarithm, representing the ratio between vapor-tension and temperature, is constant for all liquids, when they are compared under the same circumstances of pressure and temperature.

3. The latent heat of all liquids referred to one and the same pressure, multiplied by the molecular weight, referred to a uniform temperature, gives a constant product.

4. For all liquids, the difference between the latent heat at any two temperatures, multiplied by the molecular weight, is a constant number.

5. The latent heat of every liquid is a multiple of its specific heat.

It would be entering too much into detail to give the method by which these very important conclusions have been arrived at, but it may be of interest to some readers to know that an article on the subject was published by M. Pictet in the last volume of the *Philosophical Magazine*.

—*Popular Science Review.*

SCHOPENHAUER IN A NUTSHELL.

By F. HUEFFER.

IN his "Critique of Pure Reason" the great Kant has proved the absolute impenetrability by our knowledge of the essence of things. Our sensual and intellectual organs are not adapted to such knowledge. To perceive at all we must attach to the objects of our perception certain conditions and relations, which in reality are the functions of our own brains, making such perception possible. That is, in order to become aware of objects, we must regard them in their sequence after one another (time), in their various positions of coexistence (space), and finally in their mutual relations of cause and effect (causality). The ideality (i. e., objective non-reality) of time, space, and causality, taught by Kant is the final deathblow of the *a priori* dogmatism of former systems. For our intellect (using the word in the most general sense), limited by the conditions alluded to, can never go beyond the appearances of things, the phenomena. To whatever extent the exact sciences may learn the various qualities of these phenomena, there always remains and must remain a residuum of unknown essence, independent of space, time, and causality, and unaltered and undiminished after all the definable qualities alluded to (for instance, in the case of matter, weight, extension, etc.) have been deducted. This unknown essence Kant calls the "thing in itself" (*Ding an sich*), thus pronouncing the final and total bankruptcy of human reason in matters metaphysical. For what positive idea is it possible to connect with this or the still more nebulous though grander-sounding terms which later philosophers have used? Is not the "thing in itself" in reality a decorous disguise of the great unknowable, the x in the metaphysical equation of the universe?

Schopenhauer, who thus far has in essentials followed Kant, here steps in, and solves the riddle of the sphinx by the simple formula—$x =$ Will. This transfers us at once from the indefiniteness of metaphysical terminology to the firm

reality of human consciousness. We recognize the identity of our own being with the essence of all beings, and the great mystery of the world seems a total mystery no more. The accession to our store of philosophic knowledge accruing from Schopenhauer's discovery seems to me to be incalculable. To lay open its source and import to the reader will now be my task.

All things, Schopenhauer says, we observe and observe only through the medium of time, space, and causality, with one single exception—ourselves. It is true that our body, in so far as it lives and acts, and that which makes our body live and act, our will, are objects of our own perception in the ordinary sense. But apart from this perception, we are conscious of a vital principle in ourselves absolutely identical with the essence of our own being, and quite independent of and beyond our ordinary means of observation. This vital principle of the human organism is called will; it is ever present to our mind, is perceived or rather felt by us independently of time, space, or causality; it is indeed the immanent essence of our life, the "*Ding an sich*" of our being.[1] This recognition of our own being by dint of self-intuition, Schopenhauer justly calls the only possible metaphysical or philosophic knowledge in the proper sense of the word. With every change or motion of this will, he proceeds to show, a corresponding change in our body is indissolubly connected. Every movement of our hand, every beat of our pulse, are the effect of the action of our will, independently of our own consciousness of such action. Our body itself, with its nerves and fibres, its blood and its brain, is indeed nothing but this will become conscious, and observing itself through the *principium individuationis*.

With the aid of this knowledge of our being, we now look at the world around us to find that the macrocosm of the universe is only the repetition on a gigantic scale of our own tangible identity. We perceive an infinity of outward forms, organic and inorganic; plants, and birds, and beasts, and men, all fashioned after the manner of our own body, or at least submitting to the same laws of material existence. The essence or noumenon of our own body we know to be will; what, then, can be the one substratum of the universe but the same will in its various stages of consciousness and individuation? There is only the alternative between the acceptance of this reality and the theory of absolute egoism, which, as Schopenhauer observes, cannot be metaphysically disproved, but has never been seriously started out of a mad-house. Will, then, will one and universal, eternal and unchangeable in essence, although multiform in its temporal appearances, is the key-note of the harmony of the spheres, the essence of which all the wonders of the world, from the colossal immovability of a granite rock to the subtile texture of the human brain, are only signs and forms.

Let the reader pause here for a moment to realize the deep metaphysical import of this discovery. It establishes the long-sought-for unity of the world, it fills up the chasm formerly dividing mental and material forces, and at the same time it enables us, from the safe retreat of our own existence, to glance fearlessly at the enormous heaving and struggling of the universe in which we are no more entire strangers. It must not be thought that this ideal unity can be deduced from any previous system, or that Schopenhauer has only changed the name of universal force or law into will. Of force or law we know nothing, of will everything; *we are* will. Besides, why introduce a difference of term where identity of essence is all-important? And how are we to know where force ends and will begins? Organism or consciousness are no criteria in the matter, as will be seen presently. Spinoza says of a falling stone, that if it were conscious it would ascribe its movement to spontaneous action. Schopenhauer adds that the stone in thinking so would be right. For the law of gravity to which it obeys, and the motive which points out to human will the object of its desire, are convertible terms.

But I am anticipating. *Natura non facit saltus* was one of Schopenhauer's favorite maxims. To come from the stone to the individual action of human will, we must pass through the innumerable gradations of inorganic, organic, and animal life. All these Schopenhauer regards as the various stages of the "objectivation"—*sit venia verbo*—of the will. The history of the world is but the history of the struggle of will for consciousness and individuality. To attain this it fashions itself into a thousand forms, all tending toward the same goal, and all reckless of the existence of the lower types, of which they themselves are further developments. Stone and plant, animal and man, are the landmarks of this

[1] It is perhaps hardly necessary to remind the reader of the vital difference between will and volition. Volition is the temporary action of the will in accordance with a particular motive brought to bear upon it. It is, therefore, subject to time and causality, a phenomenon in short, while will is the noumenon or essence.

unceasing current of desire. In man, at last, will obtains the highest stage of its objectivation. It becomes object proper because the self-conscious subject has been created.

This, then, is what we discover in looking at ourselves and the surrounding world through the medium of Schopenhauer's philosophy. Will and interminable desire are the essence of our being, and the same desire is at the bottom of the phenomena of the world. These phenomena themselves, although we recognize their essence by analogy, surround us with bewildering horror. Everywhere we see struggle for existence, species devouring species, race contending against race;[1] even the brute earth seething and bubbling with internal fire ready to burst forth at any moment. Such is the spectacle of will in contest with itself, and devouring its own children with insatiable hunger. Surely this is not a bright picture, and Schopenhauer has painted it with the sombrest hues of despair. He lays bare the revolting cruelty of Nature, which, at the cost of inconceivable individual suffering, creates new types only to abandon them again to the universal doom of destruction. And the same tragedy is repeated in our bosom. Here, also, desire follows desire never fulfilled, or bearing disappointment and ever-new desire in its very fulfillment. Here, also, quietude and contentment are vainly sought for, the very nature of will being unrest and insatiable longing.

The beauty and grandeur of Schopenhauer's language, rivaling the highest efforts of poetry; the force and vividness with which he depicts the nothingness and misery of existence; the halo with which he surrounds the sufferings of man as the truest and noblest aspirations of his being—all this has vastly contributed to carry his name far beyond the circle of metaphysical inquirers. But is there no escape from this sea of troubles?—no compass to guide us to a haven of rest? Schopenhauer has pointed out such a way; he names one, and only one, all-healing balm for the wounds of mankind, and the name of his panacea is self-negation. We must retrace our steps for a moment. It has been shown that will in its lower forms is all but void of consciousness. It blindly pursues its struggle for individualization, and all its latent intelligent force (barely sufficient to account for the apparent teleology in Nature) is consumed in this one aim. But the case is different in the human organism. Here will at last has become conscious of itself, and its own miseries are mirrored in the intellect. By dint of this intellect will is now enabled to paralyze to some degree its own action; it can intensify this intellectual or contemplative power to such a degree as at last to become a calm looker-on at its own deeds. By thus renouncing itself in its highest stage of conscious development, will may at last find that freedom from suffering, that quiescent contentment which is forever denied to its affirmative efforts ("Bejahung und Verneinung des Willens zum Leben"). Consistently carried out, this leads to the absolute deadening of individual desire, to be met with only in certain phases of Buddhism and Christianity; and Schopenhauer by no means hesitates in adopting the extreme consequences of his doctrine. The highest stage at once of happiness and sanctity he is prone to acknowledge in the monk of the order of La Trappe, or still more in the Indian devotee who in passive contemplation awaits the dissolution of his embodied will to enter the realm of divine non-existence, Nirwana.

It is to this part of Schopenhauer's philosophy that I was chiefly referring when speaking of the influence of his time and of his own personal feeling on the development of his system. In his dark picture of human suffering he seems purposely to blind himself to the intense though transitory enjoyment of success long desired and well earned by arduous labor. A strong man conquering difficulties may rejoice in his power, and, if his will be guided and subdued by the higher motives of love and self-sacrifice, if in short he be a hero in the true sense of the word, we surely are justified (on Schopenhauer's own grounds) in exalting his virtue above the impassive selfishness of a besotted monk or fakir.

There is one other means, Schopenhauer continues, of temporarily emerging from the toil and struggle of will into the purer calm of contemplation; this means is art. The artist and he who genuinely loves art contemplate the thou-

[1] Readers who may be struck with the affinity of Schopenhauer's doctrine to certain theories of modern science (an affinity much closer than would appear from my hurried sketch), I must remind that the German philosopher's chief work was written before 1818. But even if this precedence could not be established, Schopenhauer's claim to originality would not be in any way affected. He stands altogether on a higher level than is attainable to physical science, whose results he uses for his metaphysical purpose in the same measure as those of psychology, history, comparative philology, or any other empiric discipline. He reasons where they observe, or, at best, classify. This ought to be particularly remembered in a country where scientific men proper are apt to assume not only the name but also the function of philosophers. Why the skillful handling of the microscope or of the vivisector's knife should entitle a man to speak *ex cathedra* on metaphysical questions it is not easy to perceive.

sand-fold formations of Nature and life without desire. Artistic gift, according to Schopenhauer, is the power of divesting things from their accidental surroundings, of discovering in the continual change of individual phenomena the lasting essence of the type. Genius proper is the highest degree of this intuitive knowledge, which asks no more for the how and the when and the where, but merely for the what. This "what" Schopenhauer identifies with the idea in Plato's sense. The Platonic idea he considers to be the last stage of objectivated (I again apologize for the barbarous formation) will previous to its becoming phenomenon. The idea lies beyond time, space, and causality, and is, therefore, not observable by our senses; but this does not preclude its metaphysical reality, a reality quite as undeniable and almost as tangible as the individual phenomena which are its subdivisions. Nature herself is continually struggling for the embodiment of this ideal type, but attains it rarely or never. How, then, can art hope to realize this archetypal beauty of form?

"People believe by imitating Nature. But how can the artist know the works of Nature that are beautiful and worthy of imitation among those that are not, unless his anticipation of the beautiful *precedes experience?* Moreover, has Nature ever produced a perfectly beautiful human being? It has been said that the artist must collect the beautiful single parts of various individuals, and compose with them a beautiful whole—a perverse and thoughtless opinion. For we ask again, How is he to recognize that such forms are beautiful and others the reverse? *A posteriori* and from mere experience the recognition of the beautiful is impossible; it must always be at least partly *a priori*. . . . The fact of our appreciating human beauty on seeing it, and of the artist recognizing it with such distinctness as to be able to reproduce it without ever having seen it, and to surpass Nature herself—this fact is explained by the other fact that we *ourselves are* that will, the adequate objectivation of which in its highest development is thus appreciated or discovered. . . . True genius discovers in the single phenomenon its idea. He understands the half-uttered words of Nature, and himself pronounces clearly her stammered utterance. He impresses the type of Beauty, vainly attempted by her in thousand-fold formations, on his hard marble, and places it before Nature, saying, as it were, 'See here what it was thy desire to express.'"

This is one of the two passages which the greatest artist among poets, Goethe, especially admired in the work of the greatest poet among philosophers. This testimonial alone ought to be sufficient to protect Schopenhauer from the suspicion of exaggerated idealism in art. He does not undervalue the necessity in artistic production of experience external and internal, of realism, as we should say; but this realism ought always to be illumined by the supernal light of ideal intuition. Neither does he confine his requirement of a typical background to representations of the beautiful or harmonious proper. Sir John Falstaff or Mrs. Gamp are realizations of Platonic ideas, no less than the Madonna della Sedia or the Venus of Milo.

—*Fortnightly Review.*

UNDERGROUND JERUSALEM.[1]

IT is to be regretted that Captain Warren should have thought fit to give up so much of his book upon the exploration of Jerusalem to the narration of personal grievances and by-gone difficulties, early slights suffered at the hands of indifferent boards and secretaries at home, vexatious opposition and jealous interference on the part of pashas, consuls, or rival investigators on the spot. The history of a praiseworthy and in many respects a noble work is marred by these discordant tones. Whatever may have been the "grievance" which Captain Warren claims as an Englishman's birthright, it must be idle to discuss wrongs of six or seven years' standing; while by harping upon these he wastes the opportunity of doing justice to his own real achievements, and to the substantial gains secured by the enterprise under his control. If the solid results of the Palestine Exploration Fund have thus

[1] Underground Jerusalem: An Account of some of the Principal Difficulties encountered in its Exploration, and the Results obtained, etc. By Charles Warren, Captain R. E., F. G. S., etc. London: Richard Bentley & Son. 1876.

far failed to come up to the mark fixed at the outset by its promoters, if few striking or sensational discoveries have been announced, and many of the disputed sites and other topographical or archæological problems remain as uncertain as of old, it is beyond dispute that a great deal has been added to our knowledge both of the Holy Land at large and of its sacred capital. The large-scale ordnance map, shortly, we hope, to be published, will alone amply repay the outlay upon the expedition. The labor bestowed upon the identification of sites, chiefly by means of a heedful study of the existing vernacular names, has supplied innumerable points of contact, in addition to those of previous less systematic travelers and explorers, between the Bible-text and the present features of the country. In Jerusalem itself, though only here and there has the surface of the soil been more than scratched, while local jealousy has forbidden ground even to be struck where the problem of problems awaits solution within the sacred area of the Haram, there has, notwithstanding, been a great deal done to settle the basis for future inquiries, and to narrow the boundaries of investigation, while establishing particular points of no mean value. Of the labors and hardships undergone in working up to this point of topographical knowledge the book before us gives a sketch as graphic in its details as it is modest and retiring in its tone. In the annals of the distinguished corps of royal engineers there can be few tales of patient toil and hourly risk of life more worthy of record than those which make up the unassuming narrative of "Underground Jerusalem." Shafts had to be sunk through rubbish and broken stones, which in the course of centuries had accumulated to a depth of a hundred feet or more. One main difficulty in that treeless country was the providing the wooden frames with which the shafts had to be lined. Low and narrow galleries were then driven horizontally to right or left, in which the miner, often on bended knee, by the dim light of an oil-lamp, worked his perilous way through layer after layer of loose earth or stone-chippings, loose stones occasionally bursting in upon him like water, or huge blocks crashing in upon the void thus made, crumpling up the wooden frames like paper, and threatening the explorer with instant death. No wonder that Captain Warren could speak of the strain upon the nerves during this work as intense, requiring the greatest fortitude and self-control on the part of himself as leader, of the hardy and intrepid corporal or sergeant who stoutly seconded him, and the much-enduring *fellahin* who had to be alternately coaxed and drilled into the requisite obedience. Even the power of restraining the involuntary movement of the muscles would fail at times under such tension, so that their limbs refused to obey the will, and the men had to be told off to duty above-ground until they once more became cool and collected. Captain Warren himself became familiar with this strange effect of nervous influence. Through all this he was often left without remittances, the fund being his debtor to the full extent of his private means. Added to these constant drawbacks, and perhaps most formidable of all, were the jealousies of Jews and Mohammedans alike, whose holy places or associations were threatened by Frankish intrusion, and the dull and stupid opposition of the Turkish pashas, who were at length generally best dealt with by a front of bold defiance. All things considered, Captain Warren may well be proud of the results he has to show from his seven years' researches. Until the time comes when a more liberal firman or a greater relaxation of local prejudices opens the area of the Noble Sanctuary itself to direct and thorough excavation, it is not clear what fresh discoveries of value are to be looked for within the immediate range of his investigations.

What may be laid down as absolutely fixed, and as forming the groundwork of all further detail, is the approximate parallelogram of solid masonry forming an artificial face to the native fortress of the Haram mount. That the date of this grand wall goes back in part to the time of Solomon is to be inferred from the masons' marks in red paint found upon the lowest tier of stones near the southeast angle, and held, on the authority of scholars so well qualified as Dr. Petermann and Mr. Deutsch, who saw them on the spot, to be Phœnician letters. Even though the other portions of the wall, which here and elsewhere attains from the base (through the rubbish) the full height of 150 feet assigned to it by Josephus, be referred to the time of Herod, there is convincing proof that the present Haram area was, in the time of our Lord, included within the circuit of the city wall. The idea, then, of the Sakhrah, or holy rock, in the very centre of the area, having been the site of the Saviour's burying-place—the key of Mr. Fergusson's extraordinary position—must be sent to the same limbo as the wonderful theory of the Turanians being the only builders, and Stonehenge being a Buddhist reliquary tope. No criminal, it is well known, could by Jewish law be executed or buried with-

in the city limits. We have, moreover, the express testimony of St. John's gospel (xix. 41) to the fact that *in the place where Jesus was crucified* was *the garden where he was buried.* We are, then, to conceive a malefactor crucified and buried within a few yards at most of the Holy of Holies itself! The additional reverence paid by Moslems and Jews alike to this remarkable rock as the site of the threshing-floor of Araunah, in harmony with the direct evidence of Scripture, is conclusively borne out by the researches of Captain Warren. Just such a place as this must originally have been is the customary native threshing-floor at the present day, a breezy spot on a lofty plateau of rock—in this case not quite on the ridge of Moriah, but a few feet south of it—the ridge or peak itself being occupied by the cavern for corn, the usual accompaniment to the threshing-floor, in which the grain is garnered. In this cavern, tradition says, Araunah and his sons, when they saw the destroying angel, hid themselves through fear. Be that as it may, over this hallowed site David designed to build the temple which his son was to execute, and upon the same spot was built the second temple, altered and enlarged by Herod. Here is the key to all authentic reconstruction of the lost sanctuary, with its courts and precincts. Forbidden as he was to break the sacred surface of the Noble Sanctuary, Captain Warren succeeded in opening up passages and staircases long closed with rubbish, or blocked with later masonry, so as to make his way from several points of approach to chambers or spaces beneath the surface where the temple originally stood, as laid down in the sketch-plan accompanying his work.

We cannot say that his description follows in all points the outlines given in the plan, or that the proofs he has to adduce justify throughout the boldness with which he fills up much of the detail. In the chapter describing, or rather reconstructing in idea, the original temple, Captain Warren coolly tells us he has "ignored all controversial points," and has assumed that "all are agreed in the identifications which have been alluded to." What, then, will sober students of the topography and archæology of the holy city have to say to so assured a summary of exploits as this?—

"We have been able to point out the work of King Herod, and the work of Solomon, and, if it were necessary, we could identify the additions and alterations of the Roman emperors. We can follow the description of Josephus and the Talmudic accounts, and find everything fall into its place with the ease and facility only to be obtained from correct identifications. We can stand on the spot where the sacrifices were made, where the high-priest stood once a year before the ark of the mercy-seat, where St. Simeon received our Lord, where the Sanhedrim listened to his questions, where the money-changers' tables were overturned, where the lame man was made whole, where St. Paul was carried up the steps to the Antonia, where St. James the Just stood before he was cast down. All this information is the result of our explorations, and though all do not agree with me in my indications, yet I find more do so each year. When I came back to England, I did not expect our results would be appreciated for ten years; five have now passed away, and great progress has been made."

To Captain Warren's eye the temple stands forth in real form and dimensions as if still existing. "The altar *stands* over the western end of the souterrain No. V." (in his ground-plan), where to other eyes nothing is now visible but blank and level turf. This remarkable tunnel he considers to have served in connection with the great water-system necessary for flushing the temple-courts. Whether it led from the altar to the blood-passage, discovered near the southeast angle of the Noble Sanctuary, or connected the gates Mokad and Nitsots with the temple waterworks, or whether it formed the underground communication with gate Nicanor, under which it runs, or even served all these purposes together, he is unable to decide. But, if used for the discharge of the blood, this passage, having its orifice twenty feet above the foot of the outer wall, would have sadly disfigured the brilliant white masonry which must have caught the eye of the traveler or pilgrim drawing near to the holy mount. Another rock-hewed drain, far more suitable to this purpose, has been traced under the Triple Gate. We see no proof of the identification of Mokad, the western gate, with Captain Warren's tunnel, or tank, No. I., or of Nitsots, the eastern gate, with the passage leading down to the Sakhrah, near which he also finds a place for the chamber of Parvah, a magician (according to the Talmud), who "digged a vault underground till he could come to see what the high-priest did on the day of expiation." Captain Warren seems to have made, even by the admission of the party at home, whose crotchets he had all along stoutly combated, a real hit in the discovery of the north wall of the temple, not far from the gate Tadi. But this he was not allowed to follow up, through the jealousy of the pashas, while he has the provocation of finding

it appropriated by the enemy as "the south wall of the basilica of Constantine." In the Sakhrah itself his zeal for investigation spurred him to a perilous exploit, with but little to show for what might have cost him his life, besides seriously compromising his associates. Getting three ladies, of equal courage and curiosity, to keep the attendant *zaptiehs* in talk at a distant corner of the mosque, with the late Captain Warry, R.E., on the lookout to give warning, he vaulted over the railing of the Sakhrah, which he had proviously reconnoitred, and with a light iron lever proceeded to dislodge one of the stones which formed the flooring of the cave. An old wrench of the muscles causing his shoulder to fail with the weight of the flag—which was three feet by two feet six, and nearly four inches thick—down went the stone with a thundering crash into the hollow beneath, which was, after all, no more than three feet deep. Despite the frantic terror of the Moslem friend, who unwillingly backed him in the unhallowed enterprise, Captain Warren dived into the hole, but could neither replace the stone nor make anything out of the mysterious abyss, beyond the dubious surmise that it formed a gutter to carry off the blood of the sacrifices. Happily, no harm came to the adventurous party, and in some unknown way the stone in a few days was found restored to its place.

It is in the narrative of personal adventures such as this, rather than in archæological discoveries or facts, that the attraction of Captain Warren's volume consists. His account of the Jordan Valley, his trip to Jericho, and his exploration of the mounds there, though repaying him with little more than bits of crumbling brick; his visit to the Samaritans, who form an interesting group as they are photographed at prayer, and of whose quaint yet repulsive Passover feastings he was an amused witness, show him to possess considerable powers of lively writing. This Samaritan remnant comprises no more than one hundred and fifty persons. Their physiognomy, as well as their native dress and attitude, is strongly marked, as is also that of the Ashkenazim, or German and Polish Jews, the whole body of whom in Jerusalem is no less than 6,000. One of the most valuable parts of Captain Warren's book, as well as the most novel in itself, is his statistical account of the resources of Palestine, the various classes of the population, and the different trades and callings among which they are distributed. No fewer than 1,320 shops were examined in the course of this exhaustive survey of Jerusalem; the trades, the number of active men, and their religion, being carefully noted down. The only manufacture the city can boast of is that of soap, of which our author gives ample details. Indigo-dyeing forms an industry of some importance. Captain Warren speaks of five potteries in Jerusalem, all worked by Moslems. It was probably after his time that the impulse was given to this handicraft, which has enriched many an archæological collection, notably the Imperial Museum at Berlin, with ingenious specimens of sham pottery. Captain Warren closes his somewhat desultory volume with some strictures on the past management of the Palestine Exploration Fund, in which we feel to a great extent inclined to concur. But for his complaint that we have not long ere this had a full and systematic statement of the results of excavation in Jerusalem, with a conclusive settlement of the topographical problems under dispute, we fail to see any more solid ground than his own failure to improve the opportunity.

—*Saturday Review.*

BUTTERFLIES OF THE SEA.

AWAY in the far north of the arctic regions, floating in myriads upon the surface of the northern seas, and constituting vast fields of life, through which ships may sail for days and nights together, are found multitudes of small animals, to which the appropriate name of "butterflies of the sea" has been given. To watch one of these beings, pursuing its way through the waters by means of two wing-like appendages springing from the sides of the neck, and to note the delicate body, inclosed in some cases in a delicate glassy shell, the comparison or resemblance to the aërial insect is by no means far-fetched or strained. And in their

organization and habits, these little organisms may be found to present some points of great interest to the non-technical reader; while to the naturalist they have ever afforded subjects of pleasant study and instruction.

The position of the sea-butterflies in the animal scale is of sufficiently well-determined kind. They are molluscous animals, that is, are allied to our ordinary shell-fish, such as oysters, mussels, etc., as well as to the cuttle-fishes and allied beings. Their nearest relations are undoubtedly the whelks, cowries, and other shell-fish, belonging to the great molluscan class known to naturalists as the *Gasteropoda*; and while some naturalists regard the sea-butterflies as forming a distinct group of themselves, others, and with every show of reason, maintain that they should be placed merely as a branch of the gasteropod class. The scientific appellation of our sea-butterflies is the *Pteropoda*—a name signifying "wing-footed," and which is thus of expressive enough kind, when we consider the manner in which they flit over the watery wastes.

Besides being able to swim quickly and well by aid of their wing-like fins, the sea-butterflies can descend into the ocean-depths, or ascend from these depths to the surface, at will. They appear further to come to the surface chiefly at night or in the twilight; and, as a naturalist has well remarked, each species or kind of these animals seems to have its own and special degree of darkness in which it ascends from the depths. Thus, did we know sufficient of the history of these little animals, we might be able to construct a pteropod clock by watching the respective hours of their appearance at the surface of the sea; just as the botanist forms a "floral clock" by watching the times of the opening and closing of flowers.

Being "shell-fish," the pteropods usually possess a shell; this latter structure, it must, however, be noted, not being developed in all beings. A very beautiful and at the same time most representative kind of sea-butterfly is that known by the name of the *Hyalæa*, of which kind there are several distinct species; and in this form, as well as in another well-known species called *Cleodora*, a shell is developed. The shell is thus seen to consist of a very delicate, glassy structure, somewhat triangular in shape, and of elongated form in Cleodora; that of Hyalæa being composed of two plates united together, and forming a small shell of elongated or globular shape. The little head-extremity of the animal, provided with its "wings," protrudes in each case from the front or open extremity of the shell. Another very familiar sea-butterfly is the *Clio*, which does not possess a shell, but appears as a little oblong body about an inch in length, and terminating in a lower pointed extremity.

No part of the structure of the sea-butterflies presents more surprising details than that of the head and its appendages; the latter consisting of tentacles, jaws, and like apparatus, exercising the sense of touch and other offices. Thus, on each side of the mouth of Clio, we discover three fleshy appendages, which at first sight might appear to consist of simple tentacles or organs of touch. When, however, we bring the microscope to bear upon these bodies, we note the interesting fact that the surface of each is literally studded over with numerous minute specks, which, when more fully magnified, are seen to be of hollow cylindrical shape, and to contain each about twenty little suckers. These suckers may be protruded at will from their respective cylinders, so as to constitute an efficient apparatus for seizing and detaining particles of food. Thus if we consider that each of the six tentacles bears, on an average, about 3,000 of the cylindrical bodies, and that each of the latter in turn contains about twenty suckers, we reach the enormous number of 360,000 suckers, as constituting the prehensile armament of a single Clio, itself of very small size. And imagination may assist us in its scientific aspects better than any other intellectual process, in endeavoring to form some idea of the extreme delicacy of the muscles and structures whereby the protrusion and retraction of the suckers are secured.

Two fleshy "hoods" serve to inclose the tentacles when the latter are not in use and are retracted; and other filaments exist which may be used to subserve the sense of touch in these forms. Within the little mouth of the sea-butterflies, as also well exemplified in Clio, peculiar jaws and a curious "tongue" exist, for the mastication of food. Each jaw is a conical structure, which literally bristles with sharp, spiny teeth; and the "tongue" is likewise studded over with recurved hooks, which also aid in rasping down or triturating the nutrient matters. And as completing the alimentary apparatus of the sea-butterflies, we find a well-developed throat, stomach, a large liver, salivary glands, and other addenda; while a heart is also present, along with a system of blood-vessels for the conveyance of the vital fluid through the body. The breathing-organs in some of these beings are well developed, and appear in the form of delicate gills, or analogous

structures, which are sometimes, as in Hyalæa, inclosed within a special chamber, but in others, such as Clio, are apparently unprotected, and of indistinct nature.

A very large "brain"—or at any rate a mass of nervous matter corresponding in function to the great nerve-centre of higher animals—is developed in the sea-butterflies, and can be discerned lying beneath the throat, and forming, in fact, a kind of internal collar around the gullet. And nerves accordingly radiate throughout the body from this central mass, and supply the various parts of the organism with feeling and vital power. Especially, as we might expect, do we find the delicate tentacles of the head to receive a large nerve-supply; and we may also note the presence of two eyes, situated on the back of the neck. These latter organs are not of a very high order of development, but doubtless subserve the function of guiding their possessors in their marine flights.

It is very curious to observe that, in the course of their development, the members of the higher class of the Gasteropoda already alluded to, at one period evince a strange likeness to the form of our sea-butterflies. The young whelks and their allies first appear on the stage of life as little free-swimming bodies, which move through the waters, each by means of a pair of wing-like lobes which spring from the sides of the head. Observing such a form, we cannot but be struck with its close resemblance to the mature form of our sea-butterflies—a resemblance which is, however, wholly lost as the young gasteropod advances further in its development to attain its adult stage.

The food of our sea-butterflies appears to consist of the more minute marine crustacea, which, with themselves, haunt the surface of the sea. Thus these small beings exist on organisms of still lesser magnitude. But in turn the sea-butterflies form a large proportion of the food of the largest of animals—the whales themselves. Drawn in myriads into the capacious mouth of the Greenland whale, with the floods of water which the great monster of the deep from time to time imbibes, the sea-butterflies remain entangled in the "baleen" or whalebone plates of the jaws, and are thereafter swallowed as nutriment; and the species *Clio borealis*, from this latter circumstance, becomes known to us under the popular name of "whales' food." Sea-birds also prey upon the butterflies of the ocean, which thus contribute largely to the support of much higher forms than themselves. In the Mediterranean Sea, on the Australian coasts, and in the Atlantic Ocean, the sea-butterflies also occur, but not in such numbers as in the far north, whither, to the very home of the pteropods, British enterprise has advanced on a noble mission of discovery.

Small as are all the existing representatives of the sea-butterflies, it may prove interesting to note in the last place that, in past epochs of this world's history, several relatively gigantic members of this class appear to have been developed. In some of the oldest (Silurian) rocks, large shells of Pteropoda are discovered as fossils; one extinct species, known as *Conularia*, attaining a length of about a foot, and a breadth of fully an inch—dimensions these, of giant kind, as compared with the shells of living sea-butterflies. And in more recent rocks, the small, delicate shells of our living Cleodoræ and Hyalæa may be found in a fossil state; proving thus to us the ancient ancestry of the existing "butterflies of the sea."—*Chambers's Journal.*

Ground-Water and Zymotic Disease.—Mr. Baldwin Latham, in a paper on the sanitary importance of hydro-geological surveys, cites his own observations at Croydon to show the relations between epidemics of zymotic disease and the state of the level of the ground-water. There were sixty-nine houses, some with their cesspools lying to the north and others with their cesspools lying south of them; in both, the wells were on the opposite side of the house from the cesspools. In the former houses there had always been entire immunity from zymotic disease, while in the latter the tenants had at different times suffered from this class of diseases. Careful investigation showed that the current of underground water in that locality was from southeast to northwest. Of course, in the cases where this current first passed by or through the cesspool and then reached the well, the latter was contaminated; and from the direction of the current it is plain that this condition was realized in the case of those houses which had their cesspools on the south and their wells on the north.

THE BIBLE.[1]

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II.—THE NEW TESTAMENT.

RELATION of the Earliest Christianity to the Literary and Intellectual Activity of the Age.—In the literature of Palestine at the time of Christ we distinguish a learned and a popular element. The learned class, or scribes, were busy on their twofold structure of Halacha, or legal tradition and inference, supplementing and "hedging in" the Pentateuchal law; and Haggada, or fantastic exegesis, legendary, ethical, or theosophic, under which the religious directness of the Old Testament almost wholly disappeared. The popular religious literature of the day seems again to have been mainly apocalyptic. The people never wearied of these mysterious revelations couched in strange symbolic and enigmatic forms, and placed in the mouths of ancient patriarchs and worthies, which held forth golden visions of deliverance and vengeance in a shape which, because crasser and earthlier, was also more palpable than the spiritual hopes of the old prophets. Beyond the limits of Palestine thought took a wider range. In adopting the Greek language the Hellenistic Jews had also become open to the influences of foreign speculation, and the schools of Alexandria, whose greatest teacher, Philo, was contemporary with the foundation of Christianity, had in great measure exchanged the faith of the Old Testament for a complicated system of metaphysico-theological speculations upon the Absolute Being, the Divine Wisdom, the Logos, and the like, which by the aid of allegorical interpretation were made to appear as the true teaching of Hebrew antiquity. To these currents of thought the relation of the earliest Christianity, entirely absorbed in the one great fact of the manifestation of God in Christ crucified, risen, and soon to return in glory, was for the most part hostile, when it was not merely superficial. With the spirit of the scribes Jesus had openly joined issue. In the legal tradition of the elders he saw the commandment of God annulled (Matthew xv.). It was his part not to destroy, but fill up into spiritual completeness the teaching of the old dispensation (Matthew v.); and herein he attached himself directly to the prophetic conception of the law in Deuteronomy (Matthew xxii. 37, *ff.*). And not only in his ethical teaching, but in his personal sense of fellowship with the Father, and in the inner consciousness of his Messianic mission, Jesus stood directly on the Old Testament, reading in the Psalms and Prophets, which so vainly exercised the unsympathetic exegesis of the scribes, the direct and unmistakable image of his own experience and work as the founder of the spiritual kingdom of God (*cf.* especially, Luke xxiv. 25, *ff.*). Thus, Jesus found his first disciples among men who were strangers to the theological culture of the day (Acts iv. 13), cherishing no literature but the Old Testament witness to Christ, and claiming no wisdom save the knowledge of him. At first, indeed, the church at Jerusalem was content to express its new life in simple exercises of faith and hope, without any attempt to define its relation to the past dispensation, and without breaking with the legal ordinances of the temple. But the spread of Christianity to the Gentiles compelled the principles of the new religion to measure themselves openly with the Judaism of the Pharisees. In the heathen mission of Paul the ceremonial law was ignored, and men became Christians without first becoming proselytes. The stricter pharisaically-trained believers were horror-stricken. The old apostles, though they could not refuse the right hand of fellowship to workers so manifestly blessed of God as Paul and Barnabas, were indisposed to throw themselves into the new current, and displayed considerable vacillation in their personal conduct. Paul and his associates had to fight their own battle against the constant efforts of Judaizing emissaries, and the rabbinical training acquired at the feet of Gamaliel enabled the apostle of the heathen to meet the Judaizers on their own ground, and to work out the contrast of Christianity and Pharisaism with a thoroughness only possible to one who knew Pharisaism from long experience, and had learned the gospel not from the tradition or teaching of

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men, but by the revelation of Jesus Christ (Galatians i. 12).

The relation of the first Christians to the current apocalyptic was of a different kind. The Messianic hopes already current among the first hearers of the gospel were unquestionably of apocalyptic color. And though the contents of Christian hope were new, and expressed themselves in a revival of prophetic gifts (1 Corinthians xii. 10; Acts xi. 27, etc.), it was not a matter of course that apocalyptic forms should be at once dropped, especially as Old Testament prophecy itself had inclined in its later stages toward an increasing concreteness in delineating the Messianic kingdom, and so had at least formed the basis for many apocalyptic conceptions. The apocalyptic book continued to be read, as appears from the influence of the book of Enoch on the epistle of Jude; and, after the new spirit of prophecy had died away, a Christian apocalyptic followed the Jewish models. But the way in which a genuine Christian prophecy, full of "the testimony of Jesus" (Revelation xix. 10), retained not a little of the apocalyptic manner (mainly, it is true, in dependence on the book of Daniel), appears clearly in the Revelation of John, which, whether we accept the prevalent tradition of its apostolic authorship, or, with some ancients and many moderns, ascribe it to a different John, is at least an undisputed monument of the prophecy of the apostolic age (according to modern critics, *earlier* than the fall of Jerusalem).

The influence on Christianity of Hellenistic philosophy, and, in general, of that floating spirit of speculation which circulated at the time in the meeting-places of Eastern and Western thought, was for the most part later than the New Testament period. Yet the Alexandrian education of a man like Apollos could not fail to give some color to his preaching, and in the epistle to the Hebrews, whose author, a man closely akin to Paul, is not a direct disciple of Jesus (Hebrews ii. 3), the theological reflection natural to the second generation, which no longer stood so immediately under the overpowering influence of the manifestation of Christ, is plainly affected in some points by Alexandrian views. In the case of other books the assertion of foreign speculative influences is generally bound up with the denial of the authenticity of the book in question. That the gospel of John presents a view of the person of Christ dependent on Philonic speculation is not exegetically obvious, but is simply one side of the assertion that this gospel is an unhistorical product of abstract reflection. In the same way other attacks on the genuineness of New Testament writings are backed up by the supposed detection of Orphic elements in the epistle of James, and so forth.

Motives and Origin of the First Christian Literature.—We have seen that the earliest currents of Christian life and thought stood in a very secondary relation to the intellectual activity of the period. The only books from which the Apostolic Church drew largely and freely were those of the Old Testament, and the Christian task of proclaiming the gospel was not in the first instance a literary task at all. The first writings of Christianity, therefore, were of an occasional kind. The care of so many churches compelled Paul to supplement his personal efforts by epistles, in which the discussion of incidental questions and the energetic defense of his gospel against the Judaizers, are interwoven with broad applications of the fundamental principles of the gospel to the whole theory and practice of Christian life. In these epistles, and generally in the teaching of Paul and his associates, Christian thought first shaped for itself a suitable literary vehicle. It was in Greek that the mission to the Gentiles was carried on, for that language was everywhere understood. Already in the mouths of Hellenistic Jews, and in the translation of the Old Testament, the *κοινή*, or current Greek of the Macedonian period, had been tinctured with Semitic elements, and adapted to express the ideas of the old dispensation. Now, a new modification was necessary, and soon in the circle of the Pauline churches specifically Christian ideas became inseparably bound up with words which to the heathen had a very different sense. Whether the epistolary way of teaching was used upon occasion by the older apostles before the labors of Paul, is not clear; for most scholars have declined to accept the ingenious view which sees in the epistle of James the earliest writing of the New Testament. The other epistles are certainly later, and the way in which several of them are addressed, not to a special community in reference to a special need, but to a wide circle of readers, seems to presuppose a formed custom of teaching by letter which extended from Paul not only to so like-minded a writer as the author of Hebrews (Apollos or Barnabas ?), but to the old apostles and their associates.

Besides epistles we have in the New Testament a solitary book of Christian prophecy, and a fourfold account of the gospel history, with a continuation of the third gospel in the Acts of

the Apostles. The origin and mutual relations of the gospels form at the present moment the field of numerous controversies which can only be dealt with in separate articles. We must here confine ourselves to one or two points of general bearing.

Jewish disciples were accustomed to retain the oral teaching of their masters with extraordinary tenacity and verbal exactness of memory (Mishna, *Aboth* iii. 8; *Edaioth* i. 3), and so the words of Jesus might for some time be handed down by merely oral tradition. But did the gospel continue to be taught orally alone up to the time when the extant gospels were written? or must we assume the existence of earlier evangelical writings forming a link between oral tradition and the narratives we now possess? The earliest external evidence on this point is given in the prologue to Luke's gospel, which speaks of many previous essays toward a regularly digested evangelical history on the basis of the tradition (whether exclusively oral or partly written is not expressed) of eye-witnesses who had followed the whole course of Christ's ministry. It seems to be implied that if the eye-witnesses wrote at all, they—at least, so far as was known to Luke—did not compose a regular narrative, but simply threw together a mass of reminiscences. This understanding of the words of the evangelist agrees very well with the uniform tradition of the old Church as to the second gospel, viz., that it was composed by Mark from material furnished by Peter. This tradition goes back to Papias of Hierapolis, about 150 A. D., but it is a fair question whether the second gospel as we have it is not an enlarged edition of Mark's original work. On the other hand, ecclesiastical tradition recognizes the apostle Matthew as the author of the first gospel, but does so in a way that really bears out the statements of Luke. For the tradition that Matthew wrote the first gospel is always combined with the statement that he wrote in Hebrew (Aramaic). But from the time of Erasmus the best Greek scholars have been convinced that the gospel is not a translation. Either, then, the whole tradition of a directly apostolic Aramaic gospel is a mistake, caused by the existence among the Judaizing Christians in Palestine of an apocryphal "Gospel according to the Hebrews," which was by them ascribed to Matthew, but was, in fact, a corrupt edition of our Greek gospel, or, on the other hand, what Matthew really wrote in Aramaic was different from the book that now bears his name, and only formed an important part of the material from which it draws. The latter solution is naturally suggested by the oldest form of the tradition; for what Papias says of Matthew is that he wrote τὰ λόγια, *the oracles*, an expression which, though much disputed, seems to be most fairly understood not of a complete gospel, but of a collection of the words of Christ. And if so, all the earliest external evidence points to the conclusion that the synoptical gospels are non-apostolic digests of spoken and written apostolic tradition, and that the arrangement of the earlier material in orderly form took place only gradually and by many essays. With this the internal evidence agrees. The first three gospels are often in such remarkable accord, even in minute and accidental points of expression, that it is certain either that they copied one another, or that all have some sources in common. The first explanation is inadequate, both from the nature of the discrepancies that accompany the agreement of the three narratives, and from the impossibility of assigning absolute priority to any one gospel. For example, even if we suppose that the gospel of Mark was used by the other two authors, or, conversely, that Mark was made up mainly from Matthew and Luke, it is still necessary to postulate one or more earlier sources to explain residuary phenomena; and the longer the problem is studied the more general is the conviction of critics that these sources cannot possibly have been merely oral.

It appears from what we have already seen that a considerable portion of the New Testament is made up of writings not directly apostolical, and a main problem of criticism is to determine the relation of these writings, especially of the gospels, to apostolic teaching and tradition. But, behind all such questions as the relative priority of Matthew or of Mark, the weight to be assigned to the testimony of Papias, and so forth, lies a series of questions much more radical in character, by which the whole theological world is at present agitated. Can we say of all the New Testament books that they are either directly apostolic, or, at least, stand in immediate dependence on genuine apostolic teaching, which they honestly represent? or must we hold, with an influential school of modern critics, that a large proportion of the books are direct forgeries, written in the interest of theological tendencies, to which they sacrifice without hesitation the genuine history and teaching of Christ and his apostles? There are, of course, positions intermediate to these two views, and the doctrine of tendencies is not held by many critics, even of the Tübingen school, in its extreme form. Yet, as a matter of

fact, every book in the New Testament, with the exception of the four great epistles of St. Paul, is at present more or less the subject of controversy, and interpolations are asserted even in these. The details of such a controversy can only be handled in separate articles, but a few general remarks may be useful here.

The arguments directed by modern critics against the genuineness or credibility of the New Testament books do not for the most part rely much on external evidence. Except in one or two cases (particularly that of 2 Peter), the external evidence in favor of the books is as strong as one can fairly expect, even where not altogether decisive. We shall see, when we come to speak of the canon, that, toward the close of the second century, the four gospels, the acts, thirteen epistles of Paul, the first epistles of Peter and John, and the book of Revelation, were received in the most widely-separated churches with remarkable unanimity. Before this time the chain of evidence is less complete. All our knowledge of the period that lies between the apostles and the great teachers of the Old Catholic Church toward the close of the second century is fragmentary. We possess but scanty remains of the literature, and the same criticism which seeks to bring down many New Testament books into this period, questions the genuineness of many of the writings which claim to date from the first half of the second century, and so are appealed to by conservative writers. But, on the whole, what evidence does exist is of a kind to push back all the more important writings to an early date. The gospel of John, for example, is one of the books which negative critics are most determined in rejecting. Yet the fairest writers of the school (Hilgenfeld, Keim) admit that it was known to Justin Martyr in the middle of the second century, though they think that, besides our four gospels, he had a fifth of apocryphal character. But references of an earlier date can hardly be denied; and the gospel may be traced almost to the beginning of the century by the aid of fragments of the Gnostic Basilides and of the epistles of Ignatius. The Tübingen school, indeed, maintain that the fragments preserved by Hippolytus are not from Basilides, but from a later writer of his school, and utterly reject the Ignatian epistles; but it cannot be said that they have proved their case beyond dispute. They have at most shown that, if the gospel *must on other grounds* be taken as spurious, the external evidence may be pushed aside as not absolutely insuperable. On the other hand, they try to bring positive proof that certain books were unknown in circles where, if genuine, they must have circulated. But such a negative is in its very nature difficult to prove. Probably the strongest argument of the kind is that brought to show that Papias did not know the gospel of John. But we know Papias only through Eusebius; and, though the latter is careful to mention all references to disputed books, it does not appear that it was part of his design to cite testimony to a book so universally allowed as John's gospel. And Papias does give testimony to the first epistle of John, which is hardly separable from the gospel. On the whole, then, we repeat that, on the most cardinal points, the external evidence for the New Testament books is as strong as can fairly be looked for, though not, of course, strong enough to convince a man who is sure *a priori* that this or that book is unhistorical and must be of late date.

The strength of the negative critics lies in internal evidence; and in this connection they have certainly directed attention to real difficulties, many of which still await their explanation. Some of these difficulties are not properly connected with the Tübingen position. The genuineness of 2 Peter, which, indeed, is very weakly attested by external evidence, was suspicious even to Erasmus and Calvin, and no one will assert that the Pauline authorship of 1 Timothy is as palpable as that of the epistle to the Romans. So, again, it is undeniable that the epistles to the Colossians, and the so-called epistle to the Ephesians, differ considerably in language and thought from other Pauline epistles, and that their relation to one another demands explanation. But, in the Tübingen school, all minor difficulties, each of which might be solved in detail without any very radical procedure, are brought together as phases of a single extremely radical theory of the growth of the New Testament. The theory has two bases—one philosophical or dogmatical, the other historical; and it cannot be pretended that the latter basis is adequate if the former is struck away. Philosophically, the Tübingen school starts from the position so clearly laid down by Strauss, that a miraculous interruption of the laws of Nature stamps the narrative in which it occurs as unhistorical, or, at least, as more cautious writers put the case, hampers the narrative with such extreme improbability that the positive evidence in favor of its truth would require to be much stronger than it is in the case of the New Testament history. The application of this proposition makes a great part of the narrative of the

gospels and Acts appear as unhistorical, and therefore late; and the origin of this late literature is sought by regarding the New Testament as the monument of a long struggle, in the course of which an original sharp antagonism between the gospel of Paul and the Judaizing gospel of the old apostles was gradually softened down and harmonized. The analysis of the New Testament is the resurrection of early parties in the church, each pursuing its own tendency by the aid of literary fiction. In the genuine epistles of Paul, on the one hand, and in the Revelation and some parts of Matthew on the other, the original hostility of ethnic and Jewish Christianity is sharply defined; while, after a series of intermediate stages, the Johannine writings present the final transition in the second century from the contests of primitive Christianity to the uniformity of the Old Catholic Church. This general position has been developed in a variety of forms more or less drastic, and is supported by a vast mass of speculation and research; but the turning-points of the controversy may, perhaps, be narrowed to four questions: 1. Whether, in view of Paul's undoubted conviction that miraculous powers were exercised by himself and other Christians (1 Corinthians xii. 9, *f.*; 2 Corinthians xii. 12) the miracle criterion of a secondary narrative can be maintained? 2. Whether the book of Acts is radically inconsistent with Paul's own account of his relations to the church at Jerusalem, and whether the antithesis of Peter and Paul is proved from the epistles of the latter, or postulated in accordance with the Hegelian law of advance by antagonism? 3. Whether the gospel of John is necessarily a late fiction, or does not rather supply in its ideal delineation of Jesus a necessary supplement to the synoptical gospels which can only be understood as resting on true apostolic reminiscence? 4. Whether the external evidence for the several books and the known facts of church history leave time for the successive evolution of all the stages of early Christianity which the theory postulates?

The Christian Canon of the Old and New Testaments.—We have already seen that the Apostolic Church continued to use as sacred the Hebrew Scriptures, whose authority derived fresh confirmation from the fulfillment of the prophecies in Christ. The idea that the Old Testament revelation must now fall back into a secondary position as compared with inspired apostolic teaching, was not for a moment entertained. Still less could the notion of a body of New Testament Scriptures, of a collection of Christian writings, to be read like the Old Testament in public worship, and appealed to as authoritative in matters of faith, take shape so long as the Church was conscious that she had in her midst a living voice of inspiration. The first apostolic writings were, as we have seen, occasional, and it was not even matter of course that every epistle of an apostle should be carefully preserved, much less that it should be prized above his oral teaching. Paul certainly wrote more than two epistles to the Corinthians, and even Papias is still of opinion, when he collects reminiscences of apostolic sayings from the mouths of the elders, that what he reads in books cannot do him so much good as what he receives "from a living and abiding voice." Nay, the very writers who are the first to put Old and New Testament books on a precisely similar footing (e. g., Tertullian) attach equal importance to the tradition of churches which had been directly taught by apostles, and so were presumed to possess the "rule of faith" in a form free from the difficulties of exposition that encumber the written word. In the first instance, then, the authoritative books of the Christian Church were those of the Old Testament; and in the time of the apostles and their immediate successors it was the Hebrew canon that was received. But as most churches had no knowledge of the Old Testament except through the Greek translation and the Alexandrian canon, the Apocrypha soon began to be quoted as Scripture. The feeling of uncertainty as to the proper number of Old Testament books which prevailed in the second century is illustrated by an epistle of Melito of Sardis, who journeyed to Palestine in quest of light, and brought back the present Hebrew canon, with the omission of the book of Esther. In the third century Origen knew the Hebrew canon, but accepted the Alexandrian additions, apparently because he considered that a special providence had watched over both forms of the collection. Subsequent teachers in the Eastern Church gradually went back to the Hebrew canon (Esther being still excluded from full canonicity by Athanasius and Gregory of Nazianzus), distinguishing the Alexandrian additions as ἀναγιγνωσκόμενα—books used for ecclesiastical lessons. In the Western Church the same distinction was made by scholars like Jerome, who introduced for merely ecclesiastical books the somewhat incorrect name of Apocrypha; but a laxer view was very prevalent, and gained ground during the middle ages, till at length, in opposi-

tion to the Protestants, the Council of Trent accepted every book in the Vulgate translation as canonical.

We turn now to the New Testament collection. The idea of canonicity—the right of a book to be cited as Scripture—was closely connected with regular use in public worship, and so the first step toward a New Testament canon was doubtless the establishment of a custom of reading in the churches individual epistles or gospels. The first beginnings of this custom must have been very early. The reference to Luke in 1 Timothy v. 18 is disputed, and 2 Peter iii. 16 is usually taken as one of many arguments against the genuineness of that epistle; but a citation from Matthew is certainly referred to as Scripture in the epistle of Barnabas. But such recognition of an individual gospel is a long way removed from the recognition of an apostolic canon. The apostolic writings continued to be very partially diffused, and readers used such books as they had access to, often failing to distinguish between books of genuine value and worthless forgeries. The most readers were very uncritical, and there was an enormous floating mass of spurious and apocalyptic literature, including recensions of the gospel altered by heretical parties to suit their own views. It was, perhaps, in contest with the heretics of the second century that the necessity of forming a strict list of really authoritative writings came to be clearly felt; and it is remarkable that heretics, generally hostile to the Old Testament, seem to have been among the first to form collections of Christian writings for themselves. Thus Marcion, in the middle of the second century, selected for himself on dogmatical grounds ten Pauline epistles, and a gospel which seems to have been based on Luke. Up to this time, perhaps no formal canon of sacred writings had been put forth by the Catholic Church. But in the second half of the century the notion of an authoritative New Testament collection appears in full development, and there is an amount of agreement as to the contents of the canon, which implies that, in spite of the loose way in which apocryphal books circulated side by side with genuine works, the Church had no great difficulty in drawing a sharp line between the two classes when this was felt to be necessary. At the time of the great teachers of the close of the second century (Irenæus, Tertullian, Clement), we find a twofold collection, the *Gospel* and *the Apostles*. The Gospel comprises the four evangelists; and this number was already so absolutely fixed as to admit of no further doubt.

Quite beyond dispute were also the main books of the *Apostolicon*, the Acts, thirteen epistles of Paul, 1 Peter, 1 John, and the Apocalypse. The Muratorian fragment, which contains a list twenty or thirty years older than the third century, omits 1 Peter, but adds Jude, 2 and 3 John (?), and (as a disputed book) the Apocalypse of Peter. The Shepherd of Hermas might also be read, but it is pointed out that it is of quite recent date, and not of prophetic or apostolic authority. From this time forward, then, the controversy is narrowed to a few books, occupying a middle position between the large mass of our present New Testament, which was already beyond dispute, and the spurious literature which was quite excluded from ecclesiastical use. Absolute uniformity was not at once attainable, for various churches had quite independent usages; and, as we see from the Muratorian canon, a book might receive a certain ecclesiastical recognition without being, therefore, viewed as strictly canonical. This dubious margin to the canon was of very uncertain limits, and Clement of Alexandria still uses many apocryphal books which found no acknowledgment in other parts of the Church. Gradually the list of books, which have even a disputed claim to authority, is cut down. In the time of Eusebius, the Shepherd of Hermas was still read in some churches, and several other books—the epistle of Barnabas, the Acts of Paul, the Revelation of Peter, the Teachings of the Apostles—appear as controverted writings. But all these are plainly on the verge of rejection, while, on the other hand, 2 and 3 John, Jude, James, and 2 Peter, are gradually gaining ground. This process continued to go on without interruption till at length the whole class of disputed books (*antilegomena*) melted away, and only our present canon was left on the one hand, and books of no authority or repute upon the other. Thus the Council of Laodicea was able wholly to forbid the ecclesiastical use of uncanonical books (360 A. D.), and the only uncertain point remaining in the tradition of the Eastern Church was the position of the Apocalypse, which had gradually fallen into suspicion, and was not fully reinstated till the fifth century. The Western Church, on the other hand, was long dubious as to the epistle to the Hebrews, which was received without hesitation in the East, as the Apocalypse continued to be in the West. The age of Augustine and Jerome saw the close of the Western canon.

TRANSMISSION AND DIFFUSION OF THE BIBLE IN THE CHRISTIAN CHURCH BEFORE THE INVENTION OF PRINTING.

Under this head we have to speak—1. Of the transmission of the original text; 2. Of the ancient versions:

1. *The Original Text.—Old Testament.*—The rapid spread of Christianity among the Gentiles of the West made Greek the sacred language of Christendom. Not only is Greek the language of the New Testament, but it was in the Septuagint version that the Old Testament was first circulated in the most important Gentile churches. Hebrew was almost unknown even to learned Christians, and, in fact, the current (Jewish as well as Christian) doctrine of the inspiration of the Septuagint, and a suspicion that the Hebrew text had been falsified by the Jews, made the study of the original appear unprofitable. A juster view of the value of Hebrew studies was formed by the two greatest scholars of the Patristic period, Origen and Jerome. But the Septuagint continued to enjoy an authoritative place in the Eastern Church; and the Latin Church, though it finally adopted Jerome's translation from the Hebrew in place of the older translation from the Greek, was not led by this change to take any interest in further study of the original. The Hebrew Bible continued to be the peculiar possession of the Jews, of whose labors in fixing and transmitting a standard text we have already spoken. It was not till the beginning of the sixteenth century that Christian scholars began to take a lively interest in the "Hebrew verity;" and what has been done since that time to repair so many centuries of neglect belongs to the history of the printed text or of exegesis.

New Testament.—The original copies of the New Testament writings were probably written on papyrus-rolls, and were so soon worn out by frequent use, that we do not even possess any historical notice of their existence. They must, however, have been written in *uncial* or large capital letters, without division of words or punctuation, without accents, breathings, etc., and probably without any titles or subscriptions whatever. The earliest transcripts comprised only portions of the New Testament, the gospels being oftenest copied, and the Pauline oftener than the catholic epistles. Even after the canon became fixed, MSS. of the whole New Testament, or of the whole Greek Bible, were comparatively rare. The order of the several books was not quite fixed; but the catholic epistles generally followed the book of Acts. It may also be noted that, in the oldest MSS., the epistle to the Hebrews precedes the pastoral epistles. In course of time various changes were introduced in the externals of the written text. Parchment and vellum took the place of papyrus, and form the material of the oldest extant copies. The uncial character held its ground till about the tenth century, when the use of a *cursive* or running hand became general. Attempts to indicate the punctuation go back as far as the fourth or fifth century. The oldest MSS. use for this purpose an occasional simple point, or a small blank space in the line. Another system was to write the text in short lines (στίχοι), accommodated to the sense. The author of this *stichometry* was Euthalius of Alexandria, in the second half of the fifth century, who applied it to the epistles and Acts. The same plan was afterward extended to the gospels; but vellum was too costly to allow of its general adoption. The present system of punctuation was first used in printed books. Breathings and accents were not in common use down to the end of the seventh century, but occasional traces of them seem to occur considerably earlier.

Another device for the more convenient use of the New Testament was the division of the text into sections of various kinds. The gospels were divided by Ammonius of Alexandria (220 A. D.) into short chapters (Ammonian sections, κεφάλαια), constructed to facilitate the comparison of corresponding passages of the several gospels. These sections are marked on the margin of most MSS. from the fifth century onward; and, in general, a reference is also given to the so-called canons of Eusebius, which are a kind of index to the sections, enabling the reader to find the parallel passages. Another division of the gospels into larger sections (τίτλοι, breves) is also found in MSS. of the fifth century, and a similar division of the other books into chapters (κεφάλαια) came into use not much later. The chapters of the Acts and the catholic epistles were the work of Euthalius. Our present chapters are much later. They were invented by Cardinal Hugo of S. Carus in the thirteenth century, were first applied to the Latin Bible, and are still unknown in the Eastern Church. The present system of verses first appears in the edition printed by Robert Stephens in the year 1551.

The titles and subscriptions of the New Testament books are another point on which a succession of changes has taken place. The oldest MSS. have much shorter titles than those which

the English version adopted from the later Greek text; and the subscriptions, with their would-be historical information, are not only late, but worthless. Those appended to the epistles of St. Paul are attributed to Euthalius.

More important than these external matters are the variations which in course of time crept into the text itself. Many of these variations are mere slips of eye, ear, memory, or judgment, on the part of a copyist, who had no intention to do otherwise than follow what lay before him. But transcribers, and especially early transcribers, by no means aimed at that minute accuracy which is expected of a modern critical editor. Corrections were made in the interests of grammar or of style, slight changes were adopted in order to remove difficulties, additions came in, especially from parallel narratives in the gospels, citations from the Old Testament were made more exact or more complete. That all this was done in perfect good faith, and simply because no strict conception of the duty of a copyist existed, is especially clear from the almost entire absence of deliberate falsification of the text in the interets of doctrinal controversy. To detail all the sources of various readings would be out of place; it may suffice to mention, in addition to what has been already said, that *glosses*, or notes originally written on the margin, very often ended by being taken into the text, and that the custom of reading the Scriptures in public worship naturally brought in liturgical additions, such as the doxology of the Lord's Prayer, while the commencement of an ecclesiastical lesson, torn from its proper context, had often to be supplemented by a few explanatory words, which soon came to be regarded as part of the original.

Up to a certain point the various readings due to so many different causes constantly became more and more numerous; but the number of independent readings which could arise and be perpetuated was limited by various circumstances. A general similarity necessarily prevailed in associated groups of copies, which were either derived from the same archetype, or written by the same copyist, or corrected by comparison with a single celebrated MS. Causes such as these, combined with local peculiarities of style and taste, and with the fact that the New Testament, like Christianity itself, was sent forth from central mother-churches to newly-formed communities all around, gave a decided local coloring to the text current in certain regions; so that we are still able to speak in a general way of an Alexandrian, a Western, a Byzantine, and perhaps also (with Tischendorf) of an Asiatic text. But, of course, no ancient local text remained uninfluenced by copies from other regions. The comparison of copies became more and more extended in range as the Church grew and consolidated into an homogeneous form; and though old readings, which had obtained a firm hold in certain communities, were not easily eradicated, it at length became almost impossible for any important new error to escape detection. Most variations of any consequence which are found in existing MSS. are known to be as old as the fourth century, and other readings existed then which no MS. is known to contain.

The variations of early copies were most completely smoothed into uniformity in the later Byzantine MSS., after the Mohammedan conquest had overthrown Greek learning in Syria and Egypt. The scribes of Constantinople spent great pains on the text, in accordance with their own notions of what was proper, and gave it a form which is certainly smoother, correcter, and more uniform, than that of older MSS. But precisely these peculiarities show that this late recension is remote from the original shape of the New Testament writings, and compel us to seek the true text by study of early MSS., especially of the still-existing uncial copies.

The manuscripts are of six classes, containing respectively the gospels, the Acts with the catholic epistles, the Pauline epistles, the Apocalypse, the ecclesiastical lessons from the gospels, the lessons from the Acts and epistles. Copies belonging to the last two classes are called lectionaries, and lectionaries of the gospels are called evangelistaria. Each MS. is referred to by critics by a special mark. Uncial MSS. are denoted by a capital letter, A standing for the Codex Alexandrinus, B for the Vaticanus, and so on. Cursives and lectionaries are denoted by Arabic numerals. It is to be observed that the same letter in a different part of the New Testament does not necessarily refer to the same MS. Thus Cod. D of the gospels and Acts is the Codex Bezæ, but D of the Pauline epistles is the Claromontanus. If we reckon fragments, the number of uncial MSS. is fifty-six of the gospels, fourteen of the Acts, six of the catholic epistles, fifteen of the Pauline epistles, five of the Apocalypse. But many of them are extremely short fragments. The number of cursives and lectionaries is enormous, so that altogether there are nearly a thousand MSS. for the gospels, and as many more for the rest of the New Testament. Not nearly all the cursive

copies have been thoroughly examined, and most of them have small value, though some comparatively recent MSS. are important from the fact that they represent an ancient text. Lectionaries, even when uncial, are little esteemed by most critics. Græco-Latin codices which have the Greek and Latin in parallel columns were formerly suspected of correcting the Greek text by the Latin, but their value is now generally recognized.

The oldest copies of the Greek Testament are the Codex Sinaiticus (ℵ) and the Codex Vaticanus (B), both of the fourth century. Next in age come the Alexandrian manuscript (A), and the Codex Ephraemi (C), both of which are referred to the fifth century. All of these copies were originally complete Bibles, with the Old as well as the New Testament. ℵ is still complete as regards the New Testament; A and B have lacunæ; C is very imperfect, and barely legible, the ancient writing having been almost removed by a mediæval scribe to make way for the writings of Ephraem Syrus. ℵ, A, B, C, are the four great first-rate uncials, and will be found more fully described in separate articles. Besides these there are one or two fragments as old as the fifth century (I, I^b, T).

A quite peculiar place is held by the Græco-Latin Codex Bezæ at Cambridge (D), which dates from the sixth century, but presents a text full of the most singular interpolations. The other uncials of the gospels are less important, either from their fragmentary state or from the character of their text. The later uncials are hardly more valuable than good cursives.

The most important MS. of the Acts, in addition to those already mentioned, is E, the Codex Laudianus, Græco-Latin of the sixth century, in the Bodleian at Oxford. For the Pauline epistles we may mention D, or Codex Claromontanus, at Paris, also Græco-Latin of the sixth century; and H, or Codex Coislinianus, of the same century, of which there are twelve leaves at Paris and two at St. Petersburg. Uncial authority is most scanty for the Apocalypse, for which the Vaticanus is defective. B of the Apocalypse is an uncial of the eighth century.

The Christian Versions.—We have seen that the early Church adopted the LXX., not so much in the character of a version, as in that of an authoritative original. Although several attempts were made in the second century of our era to produce a better Greek rendering of the Old Testament, not one of these seems to have had its origin in the Catholic Church. Aquila was a Jew, whose closely verbal rendering was designed to serve the subtilties of Rabbinic Exegesis. Symmachus and Theodotion were probably Ebionites. The former was an excellent master of Greek, who happily corrected many clumsy renderings of the LXX., but inclined too much to paraphrase, and to the obliteration of characteristic figures and bold expressions. Theodotion made less extensive changes, and aimed only at necessary corrections. His rendering of Daniel was so manifest an improvement that it entirely displaced the old version, and is still regularly printed as part of the LXX.

In the Christian Church the importance of these new versions and the unsatisfactory condition of the LXX.—which, apart from its original defects, had been much corrupted in successive transcriptions—were first clearly set forth by Origen in his Hexaplar edition of the Old Testament. This great work takes its name from the six columns in which it was arranged, containing respectively the Hebrew in the proper character, the same in Greek letters, the versions of Aquila, Symmachus, and Theodotion, and a text of the LXX., partly corrected by comparison of MSS., partly emended by recourse to the Hebrew. The variations of several less important versions were also noted. The complete Hexapla was too huge a work to be transcribed and circulated as a whole. It lay in the library at Cæsarea, and was only occasionally consulted by scholars; but the column containing Origen's emended text of the LXX. was published in separate transcripts by Eusebius and Pamphilus, and attained so great a circulation that in the Palestinian churches, as we learn from Jerome, it quite displaced the older text. In composing his Hexaplar text, Origen was careful to distinguish his own improvements from the original LXX. by the use of asterisks and other marks. In later copies these marks were unfortunately often omitted. The Hexaplar text became mixed up with the true LXX., and the modern critic is sometimes tempted to forget how much the Eastern Church owed to this first attempt to go back to the Hebrew Old Testament, in his impatience at the obliteration, by the adoption of Hexaplar corrections, of important divergences of the LXX. from the Masoretic text. Our knowledge of the other columns of Origen's great edition is fragmentary, and is derived partly from citations in ancient authors, partly from notes in MSS. of the Hexaplar LXX., or of the Syriac translation of it composed by Paul of Tela (616 A. D.). The best collection of these fragments is that edited by

Field ("Origenis Hexaplorum quæ supersunt," Oxford, 1867–'75).

The first origin of translations of the Christian Scriptures into the vernacular of non-Hellenic churches is involved in much obscurity. Apart from the probable existence of early Aramaic gospels, there is no sure trace of a Christian literature in any other tongue than Greek till late in the second century. Even in the churches of Gaul, Greek was the recognized language of Christian authorship. In Rome the literary use of Greek extended into the third century; and in the earliest days of the Roman Church Greek was the language of public worship. Even in remoter districts the demand for a vernacular Bible can hardly have come from the educated and reading classes, but arose rather from the custom of reading lessons from Scripture in the congregation. The earliest Christian translations are the Peshito or "Simple" version in Syria, and the Old Latin in Africa, monuments of the early vigor of two great churches on the eastern and western outskirts of Hellenic culture.

It is scarcely probable that either of these versions is older than the middle of the second century. The Syriac, which claims to be first considered, was already an old version, containing obsolete expressions, in the time of St. Ephraem, who died 373 A. D. Internal marks of antiquity are found in the relation of the Old Testament to a very early Jewish exegesis, and especially in the omission from the New Testament of 2 Peter, 2 and 3 John, Jude, and Revelation. On the other hand, there is no certain reference to this version by authors earlier than Ephraem; and the data afforded by the history of the canon, and by a comparison of the earliest remains of Syriac literature — the hymns of Bardesanes, who died about 225—are not sufficient to supply the lack of direct information. Some critics still date the version from the beginning of the second century, while others would bring it down into the third. Even the close of the third century has been named, but this view rests on the unlikely supposition that the omission of five New Testament books was due to later theological influences, and was not an original peculiarity of the version. The translation is, on the whole, excellent. The Old Testament is taken from the Hebrew, and, though sometimes dependent on Hebrew exegesis, and in other parts strongly influenced by the LXX., is decidedly superior to the Targums. The Peshito was the received version in all branches of the much-divided Syrian churches. But it did not stand alone. The Hexaplar version of Paul of Tela, and the slavishly literal Philoxinian (508 A. D. — revised a century later by Thomas of Hharkel) were presumably designed in the service of Biblical criticism. More obscure are the origin and purpose of the fragmentary version of the gospels published by Cureton in 1858, and by him supposed to be older than the Peshito.

In the history of the Old Latin version almost nothing is certain save that it originated in Africa, before the time of Tertullian, and that it assumed such protean shapes in the hands of transcribers that it is to this day uncertain whether several distinct versions are not included in the general name of the Old Latin. Jerome, indeed, speaks only of great variations between copy and copy; but Augustine tells us that the "Itala" is to be preferred to the other Latin interpretations. Hence MSS. of the Old Latin are often called copies of the Itala; but in truth no one knows what the Itala is, for it is mentioned only by Augustine, and by him but once.

A version which at best was a rude and overliteral rendering of the Greek Bible, in an unpolished provincial dialect, and which had not even that fixed form which is so necessary in a Bible for ecclesiastical use, could not continue to serve the needs of the great Latin Church; and toward the close of the fourth century a work of revision was undertaken at the instance of Damasus, Bishop of Rome, by Jerome, the most learned of the Western doctors. Jerome began by correcting the New Testament, making only such changes as seemed absolutely imperative. In the Old Testament he first revised the Psalter after the LXX., producing the version known as the Roman Psalter, from its adoption in the Roman liturgy. A second revision, based on the Hexaplar text, forms the Gallican Psalter, long used in Gaul and other churches beyond the Alps. Then Jerome proceeded to revise other books on the basis of the Hexaplar Greek; but, finding this half measure unsatisfactory, he finally rendered the Old Testament directly from the Hebrew. The work was completed 405 A. D., and though often dependent on Aquila, and especially on Symmachus, it bears high witness to the scholarship of the author, and is perhaps the best of the ancient versions. In spite of its merits the new version was much attacked, and made way in public estimation by very slow degrees. It was not till the ninth century that the Old Latin was entirely superseded in the Roman Church, and the circulation of the old and new versions side by side was long a fertile source of

corruptions in the text of both. At length the complete supremacy of Jerome's Latin was marked by the transference to it of the name of the *Vulgate Version*, which in older times was given to the LXX.

The Egyptian versions (Memphitic in the dialect of Lower Egypt, Thebaic or Sahidic for Upper Egypt) supplied the needs of the only great Christian population of the early Church which was not able to use the Greek, the Latin, or the Syriac. The most recent inquirers are disposed to believe that Egypt received the Bible in the vernacular almost as soon as Syria. The version was taken from the Greek, which was also the source of various later translations—the Ethiopic, the Armenian (fifth century), the Georgian (sixth century), the Slavonic (ninth century)—fruits of the gradual diffusion of Christianity in the remotest regions of the ancient world. The Gothic version of Ulfilas—the earliest written monument of the Teutonic languages—is of the fourth century, and was also from the Greek. Only fragments of this translation remain to us, mainly in the famous silver-lettered MS. of the fifth or sixth century (*Codex Argenteus*) in the library of Upsal.

Thus far the history of the versions records the triumphs of Christianity. The Arabic versions, on the contrary, owe their origin to the spread of Islam, when the language of the conquering Saracens displaced the ancient dialects of Syria and Egypt. This change did not diminish the authority of the old ecclesiastical versions, or displace them from their position in the services of the Church. The edification of the unlearned was secured by reading the lessons in the vulgar tongue, as well as in Syriac or Coptic; and, accordingly, the numerous Christian Arabic versions are mainly taken not from the original tongues, but from the versions whose use they were designed to supplement. In like manner the rise of the New-Persian language and literature produced a Persian version of the Syriac New Testament. Of parts of the Old Testament there are Arabic and Persian translations directly from the Hebrew, but these are the work of Jewish scholars. The Arabic versions of the Pentateuch and Isaiah, by R. Saadias Gaon, in the tenth century, are among the most important monuments of ancient Jewish learning.

In the West, as in the East, the disintegration of the Roman Empire was associated with the rise of new national dialects, and Latin ceased to be understood by the laity. But the Roman Church was too intent on the preservation of her homogeneous organization, her visible unity of worship, to allow the vulgar tongues to supplant the old liturgical language, or even to introduce a bilingual service. The use of the Bible in a form intelligible to the illiterate was shifted from the sphere of public worship to that of private edification and instruction; and for the latter purpose the necessities of a barbarous age seemed to demand explanatory paraphrases, Bible narratives in metre, and the like, rather than literal renderings of the whole Scriptures. Thus, in the Anglo-Saxon Church, Cædmon's poetical version of the Bible history dates from 664 A. D., while the earliest prose translations of parts of the Latin Bible (gospels, Psalms, etc.) do not seem to be older than the eighth century. In Germany, in like manner, metrical versions of the gospel are among the earliest attempts to convey the Bible to the people. Otfrid's harmony of the gospels in High German, and the poem called *Héliand* (Saviour), in Old Saxon, date from the ninth century; and the prose translation of the so-called "Gospel Harmony of Tatian"—from the Latin of Victor of Capua—belongs to the same age. A complete and literal translation of the Vulgate existed in Germany perhaps as early as the beginning of the fourteenth century. Among nations whose speech was descended from the vulgar Latin, the work of translation naturally began later. The earliest remains of Romance versions are thought to be as old as the eleventh century; but the work of translation assumed important dimensions mainly in connection with the spirit of revolt against the Church of Rome, which rose in the twelfth and thirteenth centuries. The study of the Bible in the vulgar tongue was a characteristic of the Cathari and Waldenses, and the whole weight of the Church's authority was turned against the use of the Scriptures by the laity. The prohibition of the Bible in the vulgar tongue, put forth at the Council of Toulouse in 1229, was repeated by other councils in various parts of the Church, but failed to quell the rising interest in the Scriptures. In England and in Bohemia the Bible was translated by the reforming parties of Wyclif and Huss; and the early presses of the fifteenth century sent forth Bibles, not only in Latin, but in French, Spanish, Italian, German, and Dutch.

The Printed Text.—Though the Latin Bible was the first book printed, the original text was for some time neglected. The Jews of Italy led the way with several editions of parts of the Old Testament, commencing with the Psalter of 1475. The beautiful edition of Soncino (1488) was the

first complete Hebrew Bible, and was soon followed by the edition of Brescia, used by Luther (1494). At length Christians interested themselves in the work. The Antwerp printer, Daniel Bomberg, established a Hebrew press in Venice, from which he sent forth a series of Bibles and other books. The famous Rabbinical Bible of 1517, edited by Felix Pratensis, a converted Jew, is known as the first Bomberg Bible, and is especially valuable for the text of the Targums, which it prints in parallel columns with the Hebrew. The second Rabbinical Bible of Bomberg was edited by R. Jacob Chayim (who also became a Christian), and contains the first printed edition of the Masora, with a text carefully corrected in accordance with Masoretic precepts. This edition at once attained a great reputation. It was several times reprinted, and most subsequent editions are directly or indirectly dependent on it. The only early edition which rivals its fame is the "Complutensian Polyglot," published at Alcala in 1517, at the expense of Cardinal Ximenes. The Hebrew of this polyglot exhibits a peculiar text, independent of the Italian editions. Later editions of the Hebrew Bible present little or no advance on the early prints; and most recent editions are decidedly inferior. Of Hebrew Bibles, with various readings from MS. authority, the best known are Kennicott's (Oxford, 1776–1780) and De Rossi's (Parma, 1784–1788). The latter collection is by far the best, but neither has done much for the improvement of the text. In fact, the differences between really good MSS. are generally very minute; and where the current text is corrupt it is not from MSS., but from the versions, or from conjecture, that help must be sought. On the other hand, a more accurate edition of the Masoretic text is certainly wanted. But such an edition must pay special regard to vowel-points and accents, which Kennicott and De Rossi neglect, and must consult MSS. of the Masora as well as of the text. The most valuable edition which notes variations not affecting the consonantal text is the Mantuan Bible of 1742–1744, with the notes of Norzi (R. Jedidiah Solomon, of Norcia). The best recent texts are S. Baer's Leipsic editions of Genesis (1869), Psalms (1861), and Isaiah (1872). Among easily accessible editions of the whole Old Testament. those of Jablonsky (Berlin, 1699) and J. H. Michaelis (Halle, 1720) have the best reputation.

The Greek New Testament was first printed in the "Complutensian Polyglot" (1514), but a delay in the publication enabled Froben of Basel to preoccupy the market with an edition hastily prepared by Erasmus from very recent codices. In subsequent editions a good many changes were made, partly after the Complutensian text, and in the third edition (1522) the spurious passage, 1 John v. 7, appeared for the first time. But it was still a recent and therefore an unsatisfactory text that was represented, and this radical defect was not corrected by the editors who followed Erasmus, though some of them, and notably Theodore Beza, possessed, and to some extent used, better MSS. than Erasmus consulted. Their beauty and convenience, rather than the merit of their text, procured a great currency for the editions of Robert Stephens (*O mirificam* editions, 1546, 1549; royal edition, 1550), and his text of 1550, or the Elzevir text of 1624, which, though mainly based on Beza, is very nearly identical with the other, came to be regarded as the "received text," which subsequent editors were long afraid to change. But materials for a better text were gradually accumulated by Walton in the London "Polyglot" (1657), Curcellæus (1658), Fell (1675), and above all by John Mill in his great edition of 1707. These labors were viewed with much jealousy by the hyper-orthodox; and even as late as 1751, Wetstein, after long and most valuable studies, could find a publisher only on consideration that his amendments on the received editions should not stand in the text. Some important steps, however, were taken in the interval between Mill and Wetstein. Bentley sketched in 1720 the plan of an edition which should restore the text of the fourth century; and Bengel in 1734 actually published an amended text, though readings which had not been given in any previous edition were admitted only in the Apocalypse. Bengel was the first who classed MSS. under families, as Asiatic and African respectively. The next great critical editor after Bengel and Wetstein was J. J. Griesbach, whose chief edition appeared 1796–1806. Griesbach gave an exaggerated importance to the doctrine of families of MSS.; and his edition was constructed on the principle of adhering to the received text, unless the reasons to the contrary were irresistible; but his industry and critical skill give him a very high place among editors. Griesbach was followed by the Roman Catholic Scholz, whose labors were more pretentious than valuable; and at length the great critic Lachmann (1842–1850) threw aside all traditional respect for the received text, and sought to restore the text of the fourth century by the aid of a very small number of select MSS., together with the Latin versions as given in the oldest copies,

and the citations of the earliest fathers. The idea was fruitful, though the material employed was too scanty. Since Lachmann published his edition, our knowledge of the most ancient authorities has been greatly increased. New MSS. have been added, notably Tischendorf's ℵ; and the MSS. formerly known have be enedited or collated with much greater accuracy. The most distinguished laborers in this work were Tischendorf and Tregelles. In addition to numerous editions and collations of ancient copies, Tischendorf put forth a series of critical editions, of which the eighth (Leipsic, 1865–1872) contains the completest critical commentary yet published. The great edition of Tregelles (1857–1872) rests exclusively on the most ancient authority, resembling Lachmann's work in conception, though using much more copious materials. This edition, as well as Tischendorf's VIII., lacks the *prolegomena*, both editors having been struck down by paralysis before their work was complete.

The recent versions, subsequent to the invention of printing and the revived study of the original tongues, demand a word in conclusion. New Latin versions naturally accompanied many of the early editions of the original text. Thus Erasmus gave many corrections of the Vulgate in his Greek Testament, the "Complutensian" gives an interlinear version of the LXX., the Genoa "Polyglot Psalter" of 1516 gives renderings both of the Hebrew and of the Chaldee. Even such works as these, designed as they were for scholars, gave offense from their appearance of undermining the authority of the Vulgate; and it was the Reformation, in its revolt against mere human authority, that first demanded open circulation of vernacular versions from the original tongues. From the time of Luther's version (New Testament, 1522; complete Bible, 1534) we may distinguish four classes of versions:

1. Versions adopted by Protestant countries or churches. Such are Luther's Bible in Germany; the Dutch Bible of the Commission of the Synod of Dort, 1637; the English Authorized Version of 1611; the Genevan French Bible, formed by successive revisions of Olivetan's version of 1535; the Danish of 1550, based on Luther, revised in 1607, 1647; the Swedish, 1541. Most of these national Bibles were preceded by earlier Protestant versions, which they supersede. Revisions of the national versions have of late years been undertaken in Norway, Holland, and Germany, as well as in England.

2. Versions which never held any other place than that of private contributions to Biblical exegesis. Such are—among older works—the Latin Old Testament of Junius and Tremellius, and the New Testament of Beza. These versions belong to the history of exegesis.

3. Missionary versions.

4. Roman Catholic versions. The Council of Trent declared the Vulgate version authentic, and forbade interpretations of Scripture not in conformity with the consent of the fathers. Vernacular versions subject to these restrictions were published as the antidote to Protestant Bibles. Such are the Rhemish and Douay versions in English. Other Roman Catholic versions owe their origin to evangelical tendencies within the Church. Jansenism, in particular, produced the French version of De Sacy (Mons, 1667), and otherwise stimulated the study of Scripture.

Literature.—Full discussion of some of the topics glanced at in this article must be sought in treatises on individual books or critical problems of the Old and New Testaments. But on most points it will be sufficient to refer to works on Biblical Introduction. The history of this branch of theology, with lists of the principal older books—some of which, including the writings of R. Simon, Carpzov, and Eichhorn, are still of value—is given in most recent works on the subject. Of these it may be sufficient to mention for the Old Testament—De Wette's "Einleitung," rewritten by Schrader (Berlin, 1869), full of condensed information; Bleek's posthumous "Einleitung" (third edition, 1870), less complete in detail and now rather behind date, but very clear and instructive; Keil's "Einleitung" (third edition, 1873), which is strictly conservative. The last two are translated. Kuenen's "Historisch-kritisch Onderzoek," of which there is a French translation, is very full, but the author has considerably changed his views in the "History of the Religion of Israel" (Haarlem, 1869–'70), of which there is an English translation. Ewald's "History of Israel" is important, and is also accessible to the English reader; with it must be taken his books on the "Prophets" and "Poets of the Old Covenant." Recent English literature on the Old Testament is not very remarkable, but Dr. S. Davidson's "Introduction" gives a full account of foreign investigations. The history of the Old Testament in the Christian Church has been written by L. Diestel ("Geschichte des alten Testamentes," u. s. w., Jena, 1869). For the New Testament, De Wette, Bleek, and Davidson, may again be consulted. A very instructive book is Reuss's "Geschichte der Heiligen Schriften Neuen Testaments" (fifth edition, Brunswick,

1874). The most recent general work proceeding from the Tübingen school is Hilgenfeld's "Historisch-kritische Einleitung in das Neue Testament" (Leipsic, 1875). On the canon there are several important works by Credner in German, and an English "History of the Canon of the New Testament," by Dr. Westcott (fourth edition, 1875). On the text of the New Testament the English reader may consult Tregelles's volume, contributed to Horne's "Introduction" (1856), and Scrivener's "Plain Introduction to the Criticism of the New Testament" (second edition, 1874). Le Long's "Bibliotheca Sacra," continued by Masch (Halle, 1778–'90), gives a full account of editions of the original text and versions, which may be supplemented by reference to De Rossi's "Annales Hebræo-typographici" (XV. Cent., Parma, 1795; MDI. to MDXL., Parma, 1799), and Reuss's "Bibliotheca Novi Testamenti Græci" (Brunswick, 1872). Detailed references to other recent books will be found in the works already cited.

COPERNICUS IN ITALY.[1]

THE celebration at Thorn, in 1873, of the four hundredth anniversary of the birth of Copernicus, was the occasion to which both the works before us owed their origin. Thus they belong to the large and increasing class which may be described as *centenary literature*. This category, indeed, includes many degrees of merit. The publication of Signor Schiaparelli, well known as the director of the Brera Observatory at Milan, although slight in form, is admirable of its kind —clear, exhaustive, and unbiased by preconceived opinions. That of Signor Berti, which has recently received considerable additions, is inferior in literary quality, but deserves praise for its painstaking accuracy of detail, and careful consultation of authorities. The purpose of the present article is not to sketch a biography of the great Polish astronomer, nor to put forward a theory as to the genesis of his system, but to point out some of the influences which he must have encountered on coming to Italy—then the intellectual hot-bed of Europe—and to trace a few among the innumerable currents of thought which must have modified the development of his ideas during his residence at Italian universities.

NICHOLAS COPERNICUS was born on February 19, 1473, at Thorn, then part of the dominions of Casimir IV. King of Poland. Some controversy as to his nationality has been caused by the inconsistent terms in which contemporary writers mention him; some speaking of him as a Prussian, others as a Pole. The truth seems to be that he was of mixed descent. His father was apparently a Slav by race, as he was certainly a Bohemian by country; his mother, Barbara Wasselrode, was an undoubted German. Although early destined for an ecclesiastical career, the native promptings of the genius of Copernicus urged him toward astronomical studies, and we find him at the University of Cracow, where he resided from 1491 to 1495, collecting from the teachings of Albert Brudzewski all that was to be known of the system then in vogue. Through the influence of his uncle, Lucas Wasselrode, Bishop of Ermland, he was, at the early age of twenty-two, raised to the dignity of Canon of Frauenburg, and having completed the obligatory year of residence, he obtained from the chapter three years' leave of absence for the purpose of completing in Italy the course of study begun in his native country. Italy was then the best school for mathematics, and practically the only one for Greek; and Copernicus coveted the mastery of both as necessary instruments for perfecting himself in the science of his choice. Thus, toward the end of 1496, he was enrolled among the students at the University of Bologna, and early in the following year the Ferrarese astronomer, Domenico Maria Novara, had already found in him a zealous assistant in his nightly observations.

Bologna at that time flourished under the outwardly beneficent tyranny of Giovanni Bentivoglio II. The tumults of communal factions and the turbulence of university riots had been alike quelled; the French cyclone had swept by on the other side of the Apennines; letters were fostered, the arts flourished, wealth increased. Whether these benefits were worth the price paid

[1] "Copernico e le vicende del Sistema Copernicano in Italia nella seconda metà del secolo XVI e nella prima del XVII." Del Professore Domenico Berti. Roma, 1876.

"I Precursori del Copernico nell' Antichità. Ricerche Storiche." Di G. V. Schiaparelli. Milano, 1873.

for them we cannot now stop to inquire. Domenico Maria Novara combined the duties of Professor of Astronomy at the university with those of astrologer in ordinary to the Prince of Bologna. Of the innumerable delusions to which mankind has been subject, judicial astrology was perhaps the most universally diffused, and it is difficult to determine whether it should be classed as a sporadic or an infectious disorder—whether it spread from one centre, or sprang up spontaneously at many points. Like all popular errors, too, it died hard. Only the most daring minds of the fifteenth century, such as Pico della Mirandola, ventured to assail its principles; and in the sixteenth and seventeenth, Girolamo Cardano, Giannantonio Magini, and other equally able men of science, were slaves to its influence. If we could imagine Zadkiel's Almanac and Ephemeris edited by the astronomer-royal, we should have a tolerably exact idea of the *prognosticons* which Novara was, by virtue of his official position, bound to publish at the beginning of every year. To flatter the fortunes of the Bentivogli, and to save the orthodox doctrine of free-will while maintaining in full force the influence of the stars, by which it was felt to be compromised, was the somewhat complicated problem which the court astrologer of Bologna had to solve. His successor, Luca Gaurico, was a less prudent courtier, though a more skillful seer. He predicted the fall of the house of Bentivoglio in the beginning of the very year (1506) in which, by a singular coincidence, it actually took place, and received the usual reward of prophets of evil—imprisonment and torture. Novara was, however, also a diligent laborer in the legitimate field of his profession, and an observation recorded by him in his *prognosticon* for 1489, although he failed to read its meaning right, is remarkable enough to deserve mention.

The slow westerly movement which carries the equinoctial points backward through all the zodiacal signs in a period of 25,868 years, although retrograde with regard to space, is called *precession*, because it causes the equinoxes to *precede* their due time by twenty minutes and nineteen seconds—the amount of difference between the tropical and sidereal years. This gradual process of change was known to the Greeks from the time of Hipparchus, and the ancient Hindoo astronomers were able to estimate its annual value with a close approach to modern accuracy. But the corresponding motion of the earth's axis, the pole of which describes a circle round the pole of the ecliptic in the same long period, had not been recognized until Novara, comparing his observations with those of Ptolemy, found that the pole of the heavens—which is nothing more than the vanishing-point of the earth's axis—had considerably changed its place among the stars. Both these variations in celestial relations—that of the equinoxes and that of the pole—are in truth but different manifestations of the same fact—the secular tilting of the earth in its orbit, caused by the action of the sun and moon on the protuberant mass at the equator. The error of Novara's inference from his observation—namely, that the celestial pole was slowly approaching the zenith—is now obvious enough; the stability of the earth's axis in the earth itself, and the consequent invariability of the distance between the pole of the heavens and the zenith, or representation in space of some given spot on the earth's surface, being considered one of the cardinal points in astronomical science.

The intimate relations then customary between master and pupil were maintained unbroken by Copernicus with Novara during the two and a half years of his residence at Bologna. He was sheltered by his roof, sat at his board, shared all his ideas, learned all his methods, and assisted him night after night in the laborious observations and calculations necessary for redetermining the positions of the 1,022 stars catalogued by Ptolemy, and estimating anew the inclination of the equator to the plane of the ecliptic. The cosmographical opinions of Novara are, therefore, of primary importance in endeavoring to estimate the influences within the reach of which Copernicus came during his stay in Italy. Two Ferrarese writers, Libanori and Barotti, assert, although without alleging any definite proof of their statement, that Novara first put forward the theory afterward adopted by Galileo, that the tides were caused by the earth's daily rotation; and the question has lately been raised whether his knowledge of the movement of the pole was compatible with a sincere adherence to Ptolemaic doctrines. This, in our opinion, hardly admits of a decisive answer. The crystal spheres of the celestial motions had been found capable of containing so many anomalies, that one additional fact would scarcely have sufficed to shatter them. Moreover, it was not to be expected that the first innovators on the existing system should be those whose emoluments and honors depended on its maintenance. We should be surprised to find railway directors engaged in promoting aëronautic science, or publicans active in the temperance movement; and astronomers

who were also astrologers would have been equally disinterested if they had helped to revolutionize the science of the stars. However, there is a strong intrinsic probability that the private opinions of Novara were favorable to the theory of the earth's motion, just then beginning to be openly discussed in Italy; and a sentence of George Joachim Rhæticus, the devoted friend and disciple of Copernicus in his later years, stating that Novara was not only an able astronomer, but also "followed the good method," gives strength to that probability.

It is, perhaps, the most singular phenomenon in the history of science that a system founded on such a total ignorance of natural forces, and involving so much that is repugnant to common-sense as the Ptolemaic cosmology, should have been universally received; and not only received, but studied, expounded, and developed, during at least fourteen centuries. This anomaly becomes somewhat less perplexing on a little consideration of its origin and history. The temperament of the Greeks did not incline them to prolonged astronomical observations. As Diodorus remarks, they had too many other interests to distract their thoughts; and they wanted that secular patience, reaching from generation to generation, which enabled the Chaldeans to establish their *great year* of 600, and the Egyptians their Sothaic period of 1,461 years. Thus, up to the time of Hipparchus, the astronomy of the Greeks consisted of some more or less ingenious theories, founded on traditions imported by their philosophers from the East—fragments, perhaps, of an older and more perfect science, which, like the submerged continent of Lemuria, survived as broken islets of truth floating in a vast sea of error. This was the opinion of Bailly; and although no longer in favor with *savants*, it receives at least some countenance from the fact that, in the Indian Tables certain of the recorded observations imply a more advanced state of knowledge than the Brahmans have, within historical times, attained; such as that of the slow shifting in space of the perihelion of the earth's orbit, and the nearly exact determination of the yearly amount of precession. Anaximander, a disciple of Thales of Miletus, was the first among the Greeks to propound the theory of the earth's rotation on its axis, and the Pythagoreans, as long as they continued to have distinctive opinions, all held more or less explicitly the same doctrine. Heraclides, of Pontus, after the middle of the fourth century B. C., made the first approach to the heliocentric theory of the planetary movements by making Mercury and Venus revolve round the sun—retaining, however, the central position of the earth with regard to the sun itself as well as the remaining planets. This doctrine, which Heraclides is supposed, on the authority of a doubtful passage in Macrobius, to have derived from the Egyptians, was carried out to its logical conclusion early in the following century by Aristarchus of Samos, to whom belongs the glory of having assigned to the earth its movement of translation as well as of rotation, and of having thus anticipated, in both its parts, the doctrine of Copernicus. This line of opinion, however, from Anaximander to Aristarchus, was but an isolated development of thought, unsupported by scientific proof, and repugnant to the *prima facie* evidence of the senses. The overwhelming preponderance of ideas conformed itself to direct appearances.

Opinions have been hitherto equally divided as to which side of the question was reënforced by the august name of Plato. The real state of the case seems to be, as Signor Schiaparelli has pointed out with much learning and acumen, that the Platonic ideas on the subject were progressive; advancing from the mythological conception of a universe whirling on the spindle of necessity,[1] to a clear grasp of the Pythagorean doctrine of the earth's rotation.[2] At an intermediate stage of his long development, he proposed to geometers the problem of accounting for the apparent motions of the heavenly bodies on the hypothesis of uniform circular motion round the earth as a centre. (It must be remembered that the Greeks carefully separated astronomy from physics; regarding the first as dealing only with mathematical possibilities, while physics took exclusive cognizance of natural laws.) Plato's challenge produced the *homocentric* system, elaborated by the mathematicians Eudoxus and Calippus, which accounted for the apparent paths of the sun, moon, and planets, supposing them to be propelled by a series of spheres revolving with different velocities round the earth as a common centre. This hypothesis answered admirably for Jupiter and Saturn, but failed to explain the anomalies of Mars, Venus, and Mercury. It was consequently abandoned in favor of the system of *eccentrics* and *epicycles*, as developed mathematically by Apollonius of Perge. Uniform circular motion, being presupposed as a necessary postulate, the accelerations and retardations of the celestial bodies were explained by supposing the

[1] "Republic," book x.
[2] "Laws," book vii.

earth to be more or less displaced from the central point of their orbits; while the planetary "stations and retrogradations" were met by the theory of *epicycles*, or smaller spheres rotating on the circumference of each great sphere, which caught the planets in their revolution, and whirled them back over a portion of the paths already traversed. This ingenious system, adopted by Hipparchus, and fortified by the irresistible authority of Ptolemy, formed the basis of the only compact body of science, except geometry, organized by the labors of antiquity. It derived the almost impregnable strength of its position from this—that it was intrenched behind a mass of observations and calculations which had a false air of scientific truth. It explained phenomena in detail, although it outraged reason in principle. The fascinating superstitions of astrology, which were closely dependent on it, helped to give it efficacy and duration; for error is persistent, though truth be invincible.

A people fresh from the reveries of the desert, whose thirst for knowledge was only equaled by their thirst for conquest, collected the inheritance of the school of Alexandria, and transmitted it to Western Europe. "Efface the Arabs from history," says Libri,[1] "and the renaissance of letters in Europe will be delayed for several centuries." And, in fact, the works of Aristotle, Euclid, and Ptolemy, were, until the fifteenth century, only known in Italy by means of translations from the Arabic; while, during great part of the middle ages, Moorish universities were the centres of culture, and Moorish geometers and astronomers the arbiters of science in Europe. But as the genius of the Arabs was decorative rather than creative, so their intellect was ingenious rather than inventive. With all their laborious patience as commentators, and subtilty as interpreters, the Arabs laid down no new line of thought, and evolved no new truths out of the old materials. Thus knowledge made no single step forward during the many centuries in which they were its custodians. The "Almagest," as they called Ptolemy's "Syntax of Astronomy" (from *al*, the Arabic article, combined with μέγιστος, greatest), was their astronomical Koran, and Ptolemy was to them as exclusively *the* astronomer as Mohammed was *the* Prophet. It was not until the revival of letters in Italy enabled Christian Europe to form an independent judgment, that the imposing prestige of Ptolemy and his Arab commentators began gradually to decline. It was found possible to conceive a constitution of the universe different from that consecrated by the authority of the Alexandrian philosopher, when other ideas were found to have been entertained by sages of equal learning and a more venerable antiquity.

It was not, however, among astronomers by profession that innovating opinions began to spread during the fifteenth century; the prejudices as well as the interests of their caste were opposed to change. Purbach and Regiomontanus were as orthodox Ptolemaists as Isaac Aben Sid or Abdurrahman Sûphi. The very complications of the system made it dear to those whose lives had been devoted to mastering its intricate details, since we value most what we have acquired with the greatest difficulty, and our past labor becomes an intimate part of our present self-love. The theory of the earth's rotation was adopted by many lay thinkers on the subject before a single expert had declared in its favor, and Celio Calcagnini, the notary of Ferrara, spoke of the contrary opinion as an error manifest to all thoughtful men, long before Magini, the Bolognese astronomer, composed his twelve books on the "Primum Mobile."

The first of these astronomical heretics was a German by birth, but an Italian by culture, a metaphysical cardinal and theologian, a dilettante in science, and one of the earliest of modern Platonic philosophers. Nicholas Krebs was the son of a poor fisherman, and was born in 1401, at Cues, on the banks of the Moselle. His remarkable talents procured for him the advantage of an education at the University of Padua, and afterward raised him to the highest honors of the Church. His philosophical writings received much attention from the Italian prelates assembled at the Council of Basle, in the stormy discussions of which he took a prominent part; and his name would no doubt have become more widely famous had not a premature death cut short his career at the comparatively early age of forty-seven. His ideas as to the constitution of the universe are contained in the singular treatise, "De Docta Ignorantia." They are founded on metaphysical rather than on scientific considerations, the conception of physical cause being as yet only dimly present to the minds of men. By a modification of the Platonic idea, Cardinal Cusa conceives the universe as a vast organism, whose life is the breath of God, having no material centre or circumference, but infinite as its Maker. He lays down as an axiom that motion can only be apprehended by comparison with what is fixed, and thence clearly deduces the motion of the earth: "*Ex his quidem manifestum est terram moveri.*"

[1] "Histoire des Sciences Mathématiques," vol. i., p. 151.

The details of his cosmical system are, it must be admitted, open to much doubt; but his design was rather to expose prevalent errors than to build up from the foundations a new structure. The point important to be held in mind is that, forty years before Copernicus was born, Cardinal Cusa clearly apprehended and pointed out, at least in principle, the difference between the real and apparent motions of the heavenly bodies. The same treatise contains some remarkable foreshadowings of subsequent discoveries, which, although conclusions drawn from false premises, show a singular intuition of scientific truth. Until Kepler discovered his first law, it was taken to be a necessary and fundamental principle of Nature, that the orbits of all the heavenly bodies were perfect circles. Even Copernicus did not venture to impugn the truth of this axiom, and was consequently compelled to impair the simple beauty of his system by retaining in it some of the rusty machinery of the Ptolemaic scheme. Cardinal Cusa, however, rejected not only uniform circular motion, but also perfect symmetry of figure as inconceivable and impossible in the existing order of things, and maintained that the figure of the earth, although closely approaching sphericity, was not that of a perfect sphere, as well as that its orbit departed to some extent from the perfectly circular form. Another passage shows a close approximation to modern ideas on the subject of the solar constitution:

"To a spectator on the surface of the sun," he says, "the splendor which appears to us would be invisible, since it contains, as it were, an earth for its central mass, with a circumferential envelope of light and heat, and between the two an atmosphere of water and clouds and of ambient air."

A somewhat obscure passage which has been generally considered to refer to the earth's orbital revolution seems to us to point rather to a proper motion of the entire solar system in space —or, as he describes it, round the poles of the world—inferred erroneously from the apparent movement of the stars really caused by precession. This curious book, which attracted much attention in Italy, was printed at Corte Maggiore in 1502—two years, that is, before Copernicus finally returned to his native land. It is therefore in the highest degree improbable that it escaped the notice of one whose faculties were, there is little doubt, already beginning to concentrate themselves on the subjects mooted by the philosophical cardinal.

There is abundant evidence that the doctrine of the earth's rotation was extensively prevalent in Italy when Copernicus took up his abode there, and Signor Berti has done good service in pointing out this interesting and hitherto almost ignored fact in the history of science. Girolamo Tagliavia, a Calabrese poet, propounded the theory in unequivocal terms toward the close of the fifteenth century; although the assertion of Zavarrone that Copernicus not only saw the poem in which these ideas were expressed, but borrowed from it its precise words, rests on no sufficient evidence, and cannot therefore be admitted to form part of history. In Bologna itself, however, during the residence of Copernicus, the subject was one of common discussion. We hear, for instance, that Codrus Urceus, Professor of Greek and Latin Letters at the university—an eccentric character, who prided himself on the poignancy of his sallies and the piquancy of his wit—was accustomed to treat those who believed in the earth's motion as favorite butts for his satire.

Somewhat later, probably about 1510, Leonardo da Vinci included the notion in his theory of falling bodies, rather as one already admitted than as needing special proof. Some of the opinions, indeed, of this miracle of genius are so far in advance of those of his contemporaries as to seem inspirations of prescience far more than inferences of ordinary reason, and can therefore hardly be treated as evidence of the common standard of thought in his time. Finally, while Copernicus, in the solitude of Frauenburg, was slowly and laboriously completing his new cosmical system, another ecclesiastic was revolving similar thoughts at the brilliant court of Ferrara. Celio Calcagnini died in 1541—two years before the great work of Copernicus saw the light—and his treatise, "Quod Cœlum stet, Terra autem moveatur," seems to have been written some years earlier. It is possible, although it does not appear, that some rumors of impending innovations in astronomical science may have reached him from Rome, where, in 1533, Widmenstadt expounded the doctrines of Copernicus with much applause to Clement VII. and his court. Calcagnini, at any rate, maintains his opinion stoutly, declaring the immobility of the earth to be the doctrine most repugnant to reason of any ever taught by philosophers, and citing sundry ancient authorities—Hicetas of Syracuse, Heraclides and Ecphantus—in support of his view. He gives no hint, however, of the earth's orbital motion. Another man, of far higher genius than the Apostolic Prothonotary of Ferrara, was busy

at the same time with another scheme for reforming the constitution of the universe. A Milanese physician named Girolamo Fracastoro, ignorant of the work being done at Frauenburg, devoted his extraordinary abilities to the ungrateful task of repairing and setting on its legs again the discarded system of homocentric spheres, which had always been a favorite with the Peripatetics, and which Dante had chosen as the framework of his wonderful Cosmos. It is evident that the time was ripe for change.

The interval between the first coming of Copernicus to Italy and his final departure from it was eight years—from the end of 1496 to that of 1504. But his sojourn was interrupted by two homeward journeys for the purpose mainly of obtaining renewed leave of absence from the Chapter of Frauenburg. The first was in 1499, after the University of Bologna had conferred upon him the degree of Doctor of Laws—*Decretorum Doctor*. Later in the same year, he returned to Bologna, accompanied by his brother Andrew; but, finding themselves in extremely necessitous circumstances—probably because the pittance which had been bread for one was starvation for two—the brothers repaired to Rome in the Jubilee year, 1500. There, for about ten months, Nicholas taught mathematics amid the plaudits of thronging audiences, and, abstracted from the calamities and crimes of the nether world, he lost himself in the contemplation of that

> "Paradise of golden lights,"

which Night opens,

> "Deep, immeasurable, vast!"

above the Capitoline ruins and palaces. One perceives that he had made good use of his time in Bologna, and had profited abundantly by the teachings of Scipionè del Ferro, Professor of Mathematics in that school. There is little or no doubt that to Del Ferro rightly belongs the discovery of the formula for solving cubic equations which goes by the name of Girolamo Cardano—a discovery, by which modern Europe made its first great scientific stride, leaving, all at once, both Greeks and Arabs at an immeasurable and increasing distance.

Again, in 1501, both Nicholas and Andrew Copernicus were in Poland, and this time the Chapter of Frauenburg granted them a more prolonged leave for the purpose of studying at Padua. The permission, we are told, was granted the more willingly, because Nicholas promised to devote himself to medicine! Thus, when, after three years' further study, he finally returned to his native land, he was a doctor in two faculties, as well as a competent classical scholar, a rare mathematician, and the astronomer all the world knows of. The remainder of his life, which reached out to seventy years, was spent in laborious and unbroken solitude. Like Dante, he lived in his book, and, like Dante, he died in giving birth to an immortal offspring. We learn from his prefatory letter to Pope Paul III. that he began the great work in which he gave permanent form to the patient convictions of his genius—"De Revolutionibus Orbium cœlestium"—in 1507, and worked at it without intermission up to the year of its publication, 1543, which was also that of the death of its author.

The evolution of ideas in the minds of men of genius is always a more or less obscure process, difficult to be traced even by the thinkers themselves, who are usually but imperfectly conscious of the successive steps by which they advance from intuition to intuition. Thought is a winged courser, whose race has neither starting-point nor goal—an apparition out of the mists of Time. The account given by Copernicus himself (in the above-mentioned letter to Paul III.) of the incubation of his new ideas is therefore not to be taken as exhaustive. The letter in question, moreover, was evidently written with a purpose. He desired to prove that the system which he advocated was, not an innovation, but a revival of opinions already sanctioned by antiquity—the *sacro-sancta antiquitas* of the Renaissance.

"He began to be weary," he says, "of the unstable theories taught in the schools as to the constitution of a machine built by the most perfect and most systematic of Artificers, and he therefore undertook the task of reperusing all that philosophers had written on the subject."

This project, the very conception of which implies a considerable acquaintance with classical literature, must have been undertaken and carried out in Italy. First, because Copernicus, until he came thither, knew little Latin and no Greek; next, because in Italy only could he have access to a sufficiently extensive collection of ancient authors to make the scheme useful or feasible. In all probability, his thoughts were first directed to the subject by the conversations which he heard carried on around him at Bologna, where the question, *An terra moveatur?* was a moot-point for discussion. Two things forcibly strike us in the apology of Copernicus for his doctrine. This contained a double innovation; it made the earth rotate on its own axis, and it made the

earth revolve in an orbit round the sun. But, in quoting the opinions of the ancients, he carefully slurs over the heliocentric portion of his scheme with an ambiguous phrase. "Philolaus the Pythagorean," he writes, "attributed to the earth *divers motions*, and classed it among the stars." Now, the cosmical scheme of Philolaus was in its essence geocentric, since the "Central Fire," round which it made the earth as well as the sun and other luminaries revolve, although not contained within the substance of the earth, was supposed to exist immediately outside it—that is, within the small circle of its daily rotation. Next, while alleging in support of his views the opinions of Hicetas, Heraclides, and Ecphantus, as well as of Philolaus, Copernicus omits all mention of the only one among the Greeks who attained to a clear conception of the true solar system—Aristarchus of Samos. Nor can it be supposed that he was ignorant of his views, since he quotes from the identical treatise by Plutarch (or some other unknown author), in which the following remarkable passage occurs: "Aristarchus numbers the sun among the fixed stars, makes the earth move in the solar circle" (the ecliptic), "and says that the shadows fall on it proportionately to its inclinations."[1] (A sufficiently clear account of the changes of the seasons.) Only one explanation occurs to us to account for this marked neglect of so decisive an authority—namely, the faint suspicion of impiety attaching to the name of Aristarchus. Cleanthes the Stoic had imputed it to him as an offense against religion that he had "disturbed the repose of Hestia," and the accusation was not without success in imposing silence upon the truth. In the sixteenth century, antiquity was still vital, and its reminiscences not ineffective. Copernicus feared lest a second Aristarchus might meet with a second Cleanthes.

Although the publication of his book was promoted by a cardinal (Schonberg), and its dedication accepted by a pope, Copernicus well knew that a great mass of prejudice remained to be overcome before his system could be finally received as the only rational interpretation of celestial phenomena. And, in fact, astronomers and mathematicians admired it as a beautiful hypothesis, but continued to take the "Almagest" for their text-book, and to make the tables of Alfonso the basis of their calculations; while Giordano Bruno, although grasping its truth with an intuition of genius, by using it as a weapon against revealed religion, excited the alarm of the simple, and prepared the tribulations of Galileo.

Although he has no claim to be ranked among the great discoverers in astronomical and mathematical science, Giordano Bruno must be placed with Galileo, and before Galileo, in the foremost rank of the champions and martyrs of scientific truth. The comprehensive audacity of his genius seized at once the bearing of the Copernican system on the whole range of human thought, no longer concentrated around the destinies of this terrestrial ball, but expanded and expanding into space, and revolving round an orb, which is but one of the luminous centres of the creation. There is nothing in language finer than some of the flashes of eloquence in which Bruno describes the effect of this illumination of his mind. But with his enthusiasm was combined a singular gift of playfulness and humor. Among other miscellaneous topics—the qualities of binaries, the hopeless dullness of the Peripatetics, the Stygian condition of London streets, and the Tartarean manners of London citizens—he discussed the Copernican philosophy in a remarkable and entertaining series of dialogues, called the "Cena de le Ceneri." The scene of this fictitious Ash-Wednesday supper is laid in "the honored dwelling of the most noble and high-bred Signor Folco Grivello" (Fulke Greville). Time, the spring of 1584—the twenty-sixth year of Elizabeth—when Bruno was the guest in London of Mauvissière, the French embassador, occupying, as he tells us, not without rancor, "a most eminent place under the roof." The purpose of the debate was to prove the truth of Copernican doctrines to the satisfaction of Greville and his friends, in the teeth of two "mad barbarians," Drs. Nundinio and Torquato. England, Bruno informs us, was fertile of such fruit—doctors fit rather to follow the plough than to adduce learned arguments; proud of refusing to believe what Aristotle was ignorant of, and not ashamed to be ignorant of all that Aristotle knew; pedants, before whose obstinate and presumptive ignorance, combined with rustic incivility, Job's patience itself must have given way.

As we read, we cease to wonder that Giordano Bruno had to fly from Paris before the rising storm of Peripatetic wrath, and that he spent his life a wanderer on the face of the earth. His sarcasms were too keen to be readily forgiven; his sneers were too constant to be lightly ignored; his very gratitude carried with it a sting, and his eulogy was dogged by a mocking shade

[1] Plutarch, "De Placitis Philosophorum," lib. ii., cap. 24, quoted by Schiaparelli. Appendix, xl.

of irony. Our English self-love suffers considerable mortification at his hands. He dipped his pen in gall when he wrote of that "happy land," guarded by Arcturus, the Bearward, under the influence of the constellation Boötes. The picture he draws of London apprentices and London roughs reminds us of the concise answer given by an African explorer of the last century, when requested to describe the manners and customs of the tribe he had visited: "Manners they have none, and their customs, sir, are very beastly." In the midst of the hustling, jeering crowd of draymen, porters, and serving-men, armed with pikes, halberds, or spits, conjured up before us by Bruno's vivid words, we seem to see his slight southern figure, trembling with rage as he feels for the handle of his Neapolitan stiletto, and faces the "grim English giants" with those sad, indomitable eyes, which might be thought to hold a foreshadowing of his tragical fate.

Although an ardent advocate of the Copernican theory in its main principles, Giordano Bruno was so on grounds of his own choosing. He pleaded the same cause, but held a different brief. He boasted of seeing with his own eyes, not with those of either Copernicus or Ptolemy; and, in point of intellectual descent, he seems more closely related to the "divine Cusa," whose works he had attentively studied, than to the sober astronomer of Thorn or the successful charlatan of Alexandria. The metaphysical flaw of the middle ages still lay at the root of Bruno's cosmical conceptions. He was no mathematician; indeed, he could hardly describe a simple geometrical figure without betraying his helplessness in this respect; and his mind was so constituted as to lead him to despise what he did not possess. "Mere mathematicians" served by their observations and calculations to prepare the way for those, like himself, gifted with deeper insight into the mighty meanings of celestial phenomena; they were translators of strange words, but without the faculty of interpreting their higher sense.

The idea of a central force ruling the motions of the planetary bodies, which had been entertained in an imperfect form by Copernicus, and which it was reserved for a still greater mind to raise to the dignity of a law, was rejected by the philosopher of Nola in one of his incisive, scornful sentences. It was to him inconceivable that force should act upon matter save by direct contact, and the difficulty of Bruno was shared by Newton, who endeavored to meet it with the untenable hypothesis of an inward pressure of space-pervading ether. The difficulty is, in truth, unanswerable, unless we suppose that impalpable substance called "ether," which we know to be diffused between star and star, as well as between atom and atom, to be the medium through which all material forces whatever, from the attraction of gravitation to chemical affinity, exert their energy. Force, acting through an absolute vacuum, is as inconceivable to us as it was to Giordano Bruno; and the attempt to realize it encounters a repugnance in our mental constitutions as strong as that which prohibits our conceiving an effect without a cause; but the inconceivability does not vanish with the use of the word "contact." *Contact* is only a rude method of describing a balance of forces. We say two bodies are in contact when the mutually attractive energy of their masses is counteracted by the repulsive energy of the particles forming their surfaces. But inter-atomic action without a conveying medium is precisely as unimaginable as the compelling action of the sun upon the earth exerted across 92,000,000 miles of blank space; and the $\frac{1}{1000}$ part of an inch, unbridged, is as metaphysically impassable as the awful gulf which separates us from the farthest nebula. Space has a relative, not an absolute existence; the measure of all things, it has itself no measure. Thus, the objection urged by Bruno against the dawning theory of gravitation applies equally to all the forces which hold together the visible frame of Nature; and, reaching deeper than he himself suspected, can only be proved to be invalid by being shown to be universal.

It was Giordano Bruno's pride to have broken down the barriers of heaven, and, like the "little old woman" on her broomstick in the nursery rhyme, to have "cleared the cobwebs out of the sky," in the shape of the last vestiges of cycles, epicycles, and rotating spheres. Space — immense, ethereal, illimitable — lay open before him; peopled with shining spheres — "the Divine Animals" of Plato — consciously rejoicing as they swept through their voluntary, majestic orbits; "constellated suns unshaken," differing from our sun in species, not in genus; "infinitely infinite" in number; nourishing in their bosoms an endless variety of sentient beings; renovated by partial change, subsisting in an eternal cause. Their motions he conceived to be imperceptible to us, not because they were "fixed," but because their revolutions, by reason of their inconceivable distance from the earth, could only be apprehended by a careful series of observations. Now, the moving principle of observation is the belief that the thing to be observed is at least possible, and

the motions of the stars had hitherto been believed to be impossible; therefore, they had remained unobserved. His daring prescience multiplied even the traditional seven planets of the solar system, which in the increasing family of the planetoids alone have, by the latest discovery of Borelli, grown to the imposing number of 172.

But with all this poetic fervor of genius, which sometimes missed its mark, and sometimes anticipated the result of much later discoveries, Giordano Bruno has left us one of the grandest and most weighty tributes to the character and genius of Copernicus himself. We shall quote the passage as a remarkable example of the great Italian style of that age:

"He was a man of grave and cultivated mind, of rapid and mature intelligence; inferior to no preceding astronomer, unless in order of succession and time; a man who in natural ability was far superior to Ptolemy, Hipparchus, Eudoxus, and all those others who followed in their footsteps. What he was, he became through having liberated himself from certain false axioms of the common and vulgar philosophy—I will not say blindness. Nevertheless, he did not depart far from them; because, studying mathematics rather than Nature, he failed to penetrate and dig deep enough altogether to cut away the roots of incongruous and vain principles, and thus, removing perfectly all opposing difficulties, free himself and others from so many empty investigations into things obvious and unchangeable. In spite of all this, who can sufficiently praise the magnanimity of this German, who, having little regard to the foolish multitude, stood firm against the torrent of contrary opinion, and, although wellnigh unarmed with living arguments, resuming those rusty and neglected fragments which antiquity had transmitted to him, polished, repaired, and put them together with reasonings more mathematical than philosophical; and so rendered that cause formerly contemned and contemptible, honorable, estimable, more probable than its rival, and certainly convenient and expeditious for purposes of theory and calculation? Thus this Teuton, although with means insufficient to vanquish, overthrow, and suppress falsehood, as well as resist it, nevertheless resolutely determined in his own mind, and openly confessed this final and necessary conclusion: that it is more possible that this globe should move with regard to the universe, than that the innumerable multitude of bodies, many of which are known to be greater and more magnificent than our earth, should be compelled, in spite of Nature and reason, which, by means of motions evident to the senses, proclaim the contrary, to acknowledge this globe as the centre and base of their revolutions and influences. Who, then, will be so churlish and discourteous toward the efforts of this man as to cover with oblivion all he has done, by being ordained of the gods as an Aurora which was to precede the rising of this sun of the true, ancient philosophy, buried during so many centuries in the tenebrous caverns of blind, malignant, froward, envious ignorance; and, taking note only of what he failed to accomplish, rank him among the number of the herded multitude, which discourses, guides itself, precipitates to destruction, according to the oral sense of a brutal and ignoble belief, rather than among those who, by the use of right reason, have been able to rise up, and resume the true course under the faithful guidance of the eye of divine intelligence."

And for this cause Giordano died. He was burned at the stake at Rome in 1600, more, we believe, for his defense of the Copernican system than for his loose life and visionary philosophy. Had Galileo not retracted, he might have shared Bruno's fate.

For himself Copernicus had nothing to fear. While his book was still in the hands of the printers of Nuremberg, he had already

"Outsoared the shadow of our night,"

and attained to the region of perfect truth—truth complete on every side. The story so often repeated, of his having died with the first printed copy of his book in his hand, must be consigned, however reluctantly, to the limbo which holds so many appropriate fables. Truth does not round off its outlines so neatly as fiction, and real life leaves many a finishing touch to be desired. Few men, indeed, have done their day's work so well as Nicholas Copernicus. He brought man a step nearer to the truth, and therefore to the Author of all truth; and the name of the obscure Canon of Frauenburg will be forever memorable as that of him who placed (to use his own stately language) "the light of the world—the orb which governs the planets in their circulation—upon a royal throne, in the midst of the Temple of Nature."—*Edinburgh Review.*

SECRET SOCIETIES IN RUSSIA.

By D. MACKENZIE WALLACE.

THE history of Russia and the history of England present two clearly-defined and widely-different types of national progress. In England we have had several important revolutions, but we may fairly say that the thread of historic continuity has never been broken, and accordingly the history of the nation presents a long and regular development little affected by foreign influences. The reform movements, whether in peaceful or in stormy times, have always proceeded—at least until quite recently, when theoretical considerations have been occasionally used for party purposes—from keenly-felt practical wants, and have subsided as soon as those wants were satisfied. The legislative and administrative authority has never slipped into the hands of pedantic professors or bureaucratic doctrinaires, but has always been wielded, or at least controlled, by men of the world, who had for the most part learned to manage their own private affairs before undertaking to manage the affairs of the State. Thus the upper classes, having constantly received a political education, have been preserved from political dreaming, and the root-and-branch method of reform has never come into fashion.

Very different has been the history of Russia during the last two centuries. In the reign of Peter the Great the thread of historical continuity was rudely snapped asunder. The old traditional methods of government were suddenly abandoned, and since that time the czars and their official advisers have ruled and reorganized according to foreign principles, without the sympathy or coöperation of the people. Being men of theory, and trammeled neither by tradition nor by practical knowledge, these legislators of the new school have habitually launched into grand schemes that would make a prosaic, practical House of Commons stand aghast, and the country has been periodically subjected to "revolutions from above" such as are inconceivable among a people accustomed to self-government.

I have no intention of discussing here the various advantages and disadvantages of these two systems of government, but I wish to point out one practical result which is closely connected with the subject of the present paper. In England the reform movement has been slow but steady; and where reformers have gained a new position, they have generally been able to hold it, for the simple reason that a very large section of the people has been ready to support them. In Russia, on the contrary, the advance has been rapid and spasmodic. It is easy, of course, to make any number of grand schemes on paper, and in a country where an uncontrolled autocrat rules over a politically passive population it is not difficult to transform any bit of paper into a law; but it is a very difficult thing, in Russia as elsewhere, to make a grand legislative scheme work well in real life among a people unprepared for it. Unforeseen practical difficulties arise, unknown disturbing forces are called into existence, the instruments do not effect what was expected of them—in a word, the plausible programme, which looked so well on paper, cannot be carried out, and the consequent despondency is in proportion to the warmth of the preceding inordinate expectations. Thus a period of violent reform is pretty sure to be succeeded by a period of equally violent reaction.

The history of the present campaign in Asia Minor has so far illustrated well the Russian character and habitual mode of action. First, great enthusiasm, inordinate expectations, and a haughty contempt for difficulties; next, a rapid advance, obstacles surmounted with wonderful facility, difficult positions stormed with reckless, dashing gallantry; and, as a result of all this, overweening confidence whispering to them that, as one of their proverbs graphically and quaintly puts it, "if they tried to ford the ocean, the waters would not rise higher than their knees." Then comes a check, obstacles are met which no amount of dash and gallantry can surmount, the over-heated enthusiasm cools, the retreat begins, the imprudence of neglecting to secure firmly and methodically the positions gained becomes apparent, and the great shadowy conquest collapses into the most modest of acquisitions. This has been the history of the campaign in Asia Minor, and it has likewise been the political history of Russia since the time of Peter the Great—a fact which may be recommended to the consideration of those who imagine that impulsiveness and spasmodic enthusiasm can flourish only in southern climes. In the opening chapter of Macaulay's history, it will be remembered, there is an eloquent passage in which national progress

is compared to the advancing tide. First the wave advances, and then it recedes, but only in order to gain new force to advance further than before. To use this metaphor, I should say that in a country like ours the waves are mere ripples. If we have what may be termed periods of Liberal enthusiasm and periods of Conservative reaction, the enthusiasm does not drive us very far forward, and the Conservatism simply stops us without perceptibly pulling us back. In countries like Russia, on the contrary, the tide advances in great rolling, foam-crested waves, and the recoil is, of course, in proportion to the impulse. It is in these moments of recoil that secret societies are likely to appear.

I say likely, because other conditions are also requisite. If a people is in a state of complete political passivity and indifference, there may be conspiracies among those who surround the throne, but there cannot be secret societies in the proper sense of the term. It is only when a certain portion of the public, excluded from political influence, have imbibed political aspirations which they are prevented from expressing freely, that the formation of secret societies becomes possible. This is well illustrated in the history of Russia. Since the end of the seventeenth century there have been four great reforming epochs, associated respectively with the names of Peter the Great, Catherine II., Alexander I., and Alexander II. Each of these violent advances was succeeded by a corresponding recoil, but the first two produced no secret societies, because the reform enthusiasm which produced them was confined to the rulers. There was no outside public sharing the enthusiasm, and excluded from the sobering influence which experience and the possession of authority naturally generate. All who moved forward in the impulsion retreated voluntarily in the recoil; and when the Emperor Paul, Catherine's son and successor, carried his reactionary policy *ad absurdum*, he was opposed, not by secret societies, but merely by a little band of conspirators—men belonging to the court—who removed him by assassination. The two more recent movements had a very different character, and of them I must speak more in detail. While resembling each other in their origin, they are very different in their character and aim, and the points of similarity and contrast were reflected in the secret societies which they produced. Let us glance first at those in the time of Alexander I.

In 1801 Alexander I. ascended the throne after the violently-repressive reign of his father Paul, who had a fanatical hatred of everything which had the least odor of liberalism. Alexander presented in almost every respect a marked contrast to his father. He had been trained under the eyes of the philosophic Catherine II. by a Swiss tutor called Laharpe, a man of high moral character and imbued with the liberalism then in fashion. Under the influence of this teacher he had, at the age of nineteen, in spite of the reactionary spirit that was then dominant at court, learned to hate despotism in all its forms, to love liberty as something to which every human being had an inalienable right, and even to rejoice at the success of the French Revolution! He wished to see republics established everywhere, and regarded that form of government as the only one consistent with the rights of man. For the first time in her history, Russia received as her legitimate, autocratic czar, a young sentimental republican!

As soon as this young republican succeeded to the throne, he determined to put his philosophical principles into practice on a grand scale. A boundless field of activity opened itself up to his imagination. He would make his subjects free, civilized, prosperous, and happy, and would then retire, like Washington, to the ranks of private life, where he would enjoy, without the cares and responsibilities of office, the love and veneration of his emancipated countrymen.

These youthful dreams, I need scarcely say, were not destined to be realized. Alexander was not of the stuff of which great reformers are made. His policy did not proceed from vigorous natural instincts, as in the case of Peter the Great, nor from keen political sagacity, as in the case of Catherine II. His political aspirations were the result of education on a weak, impressionable character, and, as such, could ill bear the rough handling of real life. He had been taught to believe that a sovereign had merely to be virtuous, well-intentioned, and animated with the liberal spirit of the time, in order to render his people prosperous and happy. But gradually he discovered how different real life is from theory. By bitter experience he learned that high aims, liberal convictions, and autocratic power do not suffice to make a successful reformer. Looking back over a reign of more than twenty years, he could not but feel that he had realized few of his youthful aspirations, and that his humanitarianism and liberalism had proved a mistake. In the army he saw insubordination and disaffection; in the civil administration ve-

nality, theft, and abuses of every kind. "These fainéants," he said, speaking of the officials, "would steal my ships of war if they had the chance; and if they could draw my teeth without my noticing it, I should have been long since without a tooth in my head." In his foreign policy he felt that he had been equally unsuccessful. The sovereigns whom he had saved in the hour of danger showed themselves ungrateful, and the nations whom he had helped to free from the Napoleonic yoke now forgot their liberator, and regarded him—not altogether without reason—with profound distrust. Even many of his own subjects, on account of his Polish schemes and his refusal to aid the Greeks against the Turks, regarded him as almost a traitor to his country and to the national faith. As is often the case with ambitious natures who fail and have not the moral energy to begin anew, he sought consolation in religious contemplation and mysticism—a world in which no energy is required, and in which there is no possibility of disappointment. Having lost his faith in liberalism, he adopted the most energetic repressive measures, and sought to root out abuses by severe punishments. In a word, the young enthusiastic sentimental republican, who at first took Washington as his model, became, in the latter years of his reign, a victim to religious melancholy and a devoted adherent of Metternich.

The events which produced this remarkable change in the emperor had a very different effect on a large section of the young noblesse. The study of French literature, and all those intellectual influences which had made him first a sentimental republican and then a believer in constitutional monarchy, had affected them in a similar way, and their enthusiasm was not, as in his case, counteracted by the sobering influence of a responsible position. During the wars with Napoleon, and the subsequent occupation of France by the allies, they became to some extent acquainted with the social and political life of Western Europe, and with the opinions and aspirations of the various political parties. On returning home they were struck with the contrast, and their excited patriotic feelings led them to seek the causes of this difference. Much that had formerly seemed to them in the nature of things, now appeared barbarous and disgraceful for a nation that professed to be civilized. The general air of poverty, the apathy and ignorance of the people, the corruption of the administration, the venality of the law-courts, the brutality of the police, the frivolity of St. Petersburg life, the want of energy in all classes of the nation—these, and a thousand little facts which had hitherto passed unnoticed, made upon them now a painful impression. What irritated them most of all was the talk of the elderly men, who praised all that was old, and condemned every attempt at reform as a dangerous innovation. They felt, as one of them afterward said, that they had got a century ahead of their fellow-countrymen.

It is always a very dangerous thing for a little group of people to get a century ahead of their contemporaries, and so it proved in this instance. The apathy of those around them, and the decidedly reactionary spirit of the government and the emperor, drove these men first into extra-legal and then into positively illegal means of realizing their reforming aspirations. At that time the most approved means of producing political and social reform were secret political societies. So it was in Germany, in France, in Italy, in Spain, and in Greece, and the young Russians naturally followed the prevailing fashion.

The first Russian secret society was formed about the year 1816, under the title of "The Union of Salvation," and was composed chiefly of officers of the Guards. Its professed aim was to struggle for the common weal, to aid in carrying out all beneficial measures of the government and all useful private undertakings, and to oppose evil of every kind—especially the malpractices of the officials. In 1818 it was reorganized on the model of the German Tugendbund, and received the new name of "Union for Public Welfare." Under this new form it proposed to itself—besides the vague aim of assisting the government in all beneficial measures—certain definite objects, the principal of which was the obtaining of representative institutions. In the years 1819 and 1820 its members rapidly increased, till nearly all the young nobles who had any pretensions to being "civilized" and "liberal" were in more or less intimate relations with it. Though it was in form and organization an illicit secret society, it had little or nothing of the nature of a conspiracy, and the great majority of the members had certainly no illicit designs. They still believed in the emperor's liberal sympathies and intentions, and on more than one occasion it was proposed to inform his Majesty of the aims and intentions of the society, and to petition him to aid them in their work.

While the great majority of the members were thus entirely innocent of treasonable or revolutionary designs—indulging in impracticable, idealistic sentimentalism, and trusting to moral

rather than political propaganda for bringing about the national regeneration—there was a small minority animated with a very different spirit, and this minority greatly increased when it became evident that the emperor was adopting the policy of Metternich. Many came to see that they had nothing to hope from voluntary concessions on the part of his Majesty, and concluded that the autocratic power must be abolished. Some were in favor of constitutional monarchy, but this idea met with little favor. French writers had proved that all forms of government in which the supreme power is hereditary must lead to despotism, while republican institutions preserve political liberty and insure a wonderfully rapid development of the national resources, all which was supposed to have been proved to demonstration by the history of Greece and Rome in ancient times, and more recently by the history of the United States.

These differences of opinion caused the society to be broken up, and the more violent members formed a new society, which took for its principle of action the French saying of its President, Pestel: "Les demi-mésures ne valent rien; il faut faire maison nette!" What Pestel understood by these words was, to raise a military insurrection, to annihilate the imperial family, and to form a provisional government under its own presidency, after which the empire would be transformed into a federation of semi-independent provinces, resembling the United States of America.

When Alexander died, and Nicholas succeeded in 1825, an attempt was made to carry out the programme, but it failed most signally. On the morning when the oath of allegiance was to be administered to the troops in St. Petersburg, several companies refused, and collected in the Senate Square. So far the conspirators were successful, but here their success ended. They had rashly crossed the Rubicon without making any plans for further action. The soldiers, deceived as to the point at issue, were ready to fight, but they had no leader. The command was hastily offered to several officers in succession, and successively declined. Every one commanded and no one obeyed. All waited for something, they knew not what, and in the mean time the troops which had taken the oath were being formed in front of them, under the command of Nicholas himself. The governor-general of St. Petersburg rode in among the mutineers, and exhorted them to return to their duty, but his words had no effect, and he was shot down by one of the officers. The two metropolitans made a similar attempt, but with as little success. At last, when all attempts at persuasion proved fruitless, the artillery fired a few round of grape-shot and cleared the square. A similar attempt in one of the southern provinces proved equally unsuccessful. The whole thing collapsed without any serious effort. A hundred and twenty-one officers were tried for high treason. Of these, five were condemned to the gallows and executed, and the others were transported to Siberia. Here ends the first chapter in the history of Russian secret societies.

The Emperor Nicholas was very different from his sentimental brother. At no period of his life did he ever show even a platonic affection for liberty in any form. He put his faith in military discipline—especially in drill—and considered it one of the chief duties of a czar to stamp out what the Liberals called "the spirit of the time." To effect this, he adopted and pushed to its extreme limit the Metternich system of police supervision and repression, and for a time the system served its purpose. During his reign tranquility reigned in Russia. The administration was incredibly corrupt, but there were no public expressions of disloyalty or liberalism—two words which were in his Majesty's mind synonymous—and no revolutionary movements even in the stormy times of '48. The police considered it necessary occasionally to send a few "restless" people to Siberia, and once they discovered—malicious, ill-intentioned people said invented—a political conspiracy; but there was nothing that could be called, even in elastic official language, a secret society. Had Nicholas died in 1852, his last moments might have been comforted by the conviction that he had fulfilled the whole duty of an autocrat, and that the system he loved so well had proved a brilliant success. That illusion was rudely dispelled by the Crimean war.

In the history of England and France that war is but an episode of second-rate importance; for Russia it was an event of the first magnitude, for it was the direct cause, as I have elsewhere explained, of all those great reforms which have made the present reign one of the most important epochs of Russian history.

In many respects the present reign resembles that of Alexander I. Both open with a violent outburst of reform enthusiasm, and in both cases the emperor puts himself at the head of the reform movement. For a time all goes well. Great reforms are conceived and partly executed, and

many sanguine people believe that a national millennium is at hand. But gradually the enthusiasm cools under the influence of chilly experience. The chilling process naturally takes place more rapidly among those in authority. The new institutions do not work nearly so well in reality as on paper, and new forces appear which do not readily submit to control. The government think it well to apply the curb, first in an intermittent, irritating way, and then in a more decided, systematic fashion. This is naturally resented by the enthusiastic, sanguine people, and the cry is raised that the reaction has set in. It is no longer possible, they say, to trust to the government for the realization of the expected millennium. If it is to be realized, extra-legal means must be employed. In a word, the stage is again prepared for the entrance of secret political societies.

In the present reign the cooling process commenced almost as soon as the emancipation law began to be put in execution, in 1861. Serf-emancipation—the conferring of liberty and civic rights on forty millions of human beings—is of course a grand thing, of which a nation should be proud, and with which every patriotic man with any pretensions to being civilized and liberal must warmly sympathize; but when this great event accidentally deprives you of all power over one-half of your estate, and you find that your serfs are dissatisfied because they do not get the whole of it, probably you will feel—especially if your liberalism and patriotism be of the vaporing, rhetorical type—that really liberalism may be pushed a little too far. So, at least, thought many of the Russian proprietors. On the other hand, certain youths, not amenable to sobering influences, held that the emancipation law and the government in general were not nearly liberal enough. These considered that more land and less taxation should have been given to the peasantry, and after due consideration arrived at the conviction that the best way to mend matters was to write and disseminate the most terrifically seditious proclamations. Then there were the disorders in the universities; and, above all, there were the Nihilists. What are the Nihilists? That is a question which I have often put to men who ought to be competent authorities, and I have never received a satisfactory explanation, but there is no difficulty in describing the popular conception of them. According to popular opinion, they were a band of fanatical young men and women—many of them medical students—who had determined to turn the world upside down, and to introduce "a new kind of social order," founded on the most advanced principles, communistic and otherwise. They had discovered that the two chief fountains of crime and human misery, viz., lust and the desire of gain, might be hermetically sealed by abolishing the obsolete institutions of marriage and private property. When society would be so organized that all the natural instincts of human nature would find complete and untrammeled satisfaction, there would be no inducement to commit crime. That could not, of course, be effected instantaneously, but something might be done at once. The adherents of the new doctrines accordingly reversed the traditional order of things in the matter of coiffure: the males allowed their hair to grow long, and the female adepts cut their hair short, adding occasionally the additional badge of blue spectacles. Their appearance naturally shocked the æsthetic feelings of ordinary people, but to this they did not object. They had raised themselves above the level of popular notions, were indifferent to so-called public opinion, despised Philistine respectability, and rather liked to scandalize people with antiquated prejudices. Besides this, they had a special grudge against the worship of æsthetic culture. Professing extreme utilitarianism, they explained that the shoemaker who practises his craft is, in the true sense, a greater man than a Shakespeare or a Goethe, because humanity has more need of shoes than poetry. Strange to say, the opera found favor in their eyes—perhaps because the founder of modern theoretical Communism had included operatic representations in his *phalanstère* programme. Perhaps the most curious part of this curious phenomenon was the prominence of the female element in all the demonstrations. When the students held meetings against the orders of the authorities, ladies in short hair and blue spectacles were generally among the orators.

Let it be distinctly understood that I am describing not the Nihilists but simply the popular conception of them. Some of their friends have assured me that this conception is radically false. According to these authorities there never were any Nihilists. The people to whom this name was applied were simply students who desired beneficent liberal reforms. The peculiarities in their costume arose merely from a laudable neglect of trivialities in view of graver interests. However this may be—and I do not pretend at present to decide the question—many people were alarmed, and the reaction was prepared in

consequence. To illustrate this, I may quote here part of an unpublished letter, written in October, 1861, by a man who now occupies one of the highest positions in the administration. At that time he was regarded as ultra-liberal, and consequently we may assume that, relatively speaking, he did not take a very alarmist view of the situation. Here is what he says, writing to a near relative:

"You have not been long absent—merely a few months; but, if you returned now, you would be astonished by the progress which the opposition—one might say the revolutionary party—has already made. The disorders in the university do not relate merely to the students. I see in the affair the beginning of serious dangers for public tranquillity and the existing order of things. Young people, without distinction of costume, uniform, and origin, take part in the street demonstrations. Besides the students of the university there are the students of other institutions, and a mass of people who are students only in name. Among these last are certain gentlemen in long beards and *revolutionnaires* in crinoline who are of all the most fanatical. Blue collars—the distinguishing mark of the students' uniform—have become the *signe de ralliement*. Almost all the professors, and many officers, take the part of the students. The newspaper critics openly defend their colleagues. Mikhaïlof has been convicted of writing, printing, and circulating one of the most violent proclamations that ever existed, under the title of 'To the Young Generation.' Among the students and the *littérateurs* there is unquestionably an organized conspiracy, which has perhaps leaders outside the literary circle. The Polish students have not yet spoken out in this movement, but they are so self-confident that. . . . The police are powerless. They arrest any one they can lay their hands on. About eighty people have been already sent to the fortress and have been examined, but all this leads to no practical result, because the revolutionary ideas have taken possession of all classes, all ages, all professions, and are publicly expressed in the streets, in the barracks, and in the ministries! I believe the police itself is carried away by them. What all this will lead to it is difficult to predict. I am very much afraid of some bloody catastrophe. Even if it should not go to such a length immediately, the position of the government will be extremely difficult. Its authority is shaken, and all are convinced that it is powerless, stupid, and incapable. On that point there is the most perfect unanimity among parties of all colors, even the most opposite. The most desperate 'planter'[1] agrees in that respect with the most desperate socialist. Meanwhile those who have the direction of affairs do almost nothing, and have no plan or definite aim clearly in view. At present the emperor is not in the capital, and now, more than at any former time, there is complete anarchy in the absence of the master of the house. There is a great deal of bustle and talk, and all blame they know not whom."[1]

[1] An epithet commonly applied, at the time of the emancipation, to the adherents of serfage and the defenders of the proprietors' rights.

The expected revolution did not take place, but timid people had no difficulty in perceiving signs of its approach. The press continued to disseminate under a more or less disguised form ideas which were considered dangerous. The *Kolokol*, a Russian paper published in London by Herzen, and strictly prohibited by the Press-censure, found its way regularly into the country, and was eagerly read by thousands. The youth, it was said, was being corrupted by socialistic ideas. Young girls of respectable family had been heard to express most objectionable views on the subject of matrimony. Not a few suspected that a great Nihilist organization had been secretly formed for the overthrow of society; and this suspicion found confirmation in several great fires which broke out in St. Petersburg and other towns, and which were believed to be the work of Nihilist incendiaries.

Soon a new event came to strengthen the reactionary influences. In the beginning of 1863 the Polish insurrection broke out. That ill-advised attempt on the part of the Poles to recover their independence had a curious effect on Russian public opinion. There was at that time in Russia a very large amount of generous liberal sentiment, which was, perhaps, not very deep, but was at least genuine so far as it went. Both the government and the better section of the educated classes were ready to grant to Poland very considerable concessions. The Poles were to have their own administration and almost complete autonomy, under the viceroyalty of a Russian grand-duke. Whether the scheme would have succeeded, if the Poles had shown sufficient political tact and patience, is a question that need not here be discussed. Political tact and patience are not prominent features of the Polish character, and certainly they were not displayed on this occasion. The new administration committed some grave mistakes, and the Poles appealed to arms. As the news of the rising spread over Russia, there was a moment of hesitation. Those who had been for several years habitually extolling liberty and self-government as the necessary conditions

[1] For obvious reasons I refrain from naming the writer of this letter, which accidentally fell into my hands.

of all progress, and sympathizing warmly with every Liberal movement, whether at home or abroad, could not well frown upon the political aspirations of the Poles. The Liberal sentiment of that time was so extremely philosophical and cosmopolitan that it scarcely distinguished between Poles and Russians, and liberty was supposed to be a good and grand thing in Warsaw as well as in St. Petersburg. But underneath this fair artificial growth of cosmopolitan liberalism lay the volcano of national patriotism—dormant for the moment, but by no means extinct. Though the Russians are, in some respects, the most cosmopolitan of the European nations, they are at the same time capable of indulging in violent outbursts of patriotic fanaticism; and these two contradictory elements in their character were brought into contact by the news of the Polish insurrection. The struggle was only momentary. Ere long the patriotic feelings burst forth, and carried all before them. The *Moscow Gazette* thundered against the pseudo-Liberal sentimentalism which would, if unchecked, necessarily lead to the dismemberment of the empire; and Mr. Katkoff, the editor of that paper, became for a time the most influential private individual in the country. A few, indeed, remained true to their convictions. Herzen, for instance, wrote in the *Kolokol* a glowing panegyric on two Russian officers who had refused to fire on the insurgents, and here and there a man might be found who confessed that he was ashamed of the severity displayed in Lithuania.[1] But such men were few, and were commonly regarded almost as traitors. The great majority of the public thoroughly approved of the severe energetic measures adopted by the government, and, when the insurrection was suppressed, men who had a few months previously spoken and written in magniloquent terms about humanitarian liberalism joined in the ovations given to Muraviéff! At a great dinner given in his honor, that energetic and by no means too humane administrator, who had systematically opposed the emancipation of the serfs, and had never concealed his contempt for the Liberal ideas recently in fashion, could ironically express his satisfaction at seeing so many "new friends" around him.[2]

Still the government, while repressing all political agitation, did not abandon its policy of introducing reforms by means of the autocratic power. The Zemstvo, a system of local self-government comprising periodical elective assemblies, was created, and preparations were made for thoroughly reorganizing the law-courts and the judicial procedure. But in 1866 a new event came to strengthen the reactionary influence. A foolish, misguided youth, called Karakózof, made an attempt on the life of the emperor. The effect of such an incident on his Majesty and on those who surrounded him may easily be imagined. Report says—though I must add that I have never seen the official documents relating to this affair—that the would-be assassin, formerly a student, belonged to a little domestic community composed of two or three youths of not very satisfactory moral character, and calling itself by the ill-sounding name of *Ad*, that is to say, Hell.

This incident, in conjunction with the others which I have indicated, induced the government to take energetic measures. It was found that the agitation proceeded in all cases from young men who were studying, or had recently studied, in the universities, the seminaries, and the technical schools, such as the Medical Academy and the Agricultural Institute. Plainly, therefore, the system of education was at fault. The semi-military system of the time of Nicholas had been succeeded by one in which discipline had been reduced to a minimum, and the study of natural science formed a prominent element. Here, it was thought, lay the chief root of the evil. Englishmen may have some difficulty in imagining a possible connection between natural science and revolutionary agitation. To them the two things must seem wide as the poles asunder. Surely mathematics, chemistry, physiology, and similar abstract subjects have nothing to do with politics. Certainly they have not much to do with each other in this country, but in Russia it is different. This is one of the many curious and interesting phenomena to be found in the present intellectual condition of the Russian educated classes. To explain it would require at least a long article, so I must content myself for the present with simply indicating the explanation. When an Englishman undertakes the study of any branch of natural science, he gets up his subject by means of lectures, text-books, and museums or laboratories,

[1] I have heard, at least, two genuine, nominally orthodox Russians make statements of this kind. I must, however, in fairness add that the conceptions commonly held in Western Europe regarding Muraviéff and his administration are, though not without a foundation of fact, in my opinion, gross exaggerations.

[2] Count Muraviéff has left a most interesting autobiographical fragment relating to the history of this time, but it is not likely to be published during the lifetime of the present generation. As an historical document it is very valuable, but must be used with extreme caution. A copy of it was for some time in my possession, but I was bound by a promise not to make extracts from it.

and when he has mastered it he probably puts his knowledge to some practical use. The man who has studied the medical sciences becomes a doctor; the student of chemistry finds employment as a professor or in a factory; the mathematician becomes, perhaps, an engineer. Probably none of these men feel any desire to enter political life or imagine that their previous studies have specially fitted them for such activity. In Russia it is otherwise. Few students confine their attention to their specialty. Many of them dislike the laborious work of getting up details, and with the presumption which is often to be found in conjunction with youth and ignorance, aspire to become social reformers. But what has social reform to do with natural science? To understand the connection the reader must know that, though very few Russian students have opened the voluminous works of Auguste Comte, nearly all of them are more or less imbued with the principles of positivism. Now, in the "Positive Philosophy" the study of natural science leads to the study of sociology. In the classification of the sciences proposed by Comte, sociology is the main part of the edifice, and to it all the other sciences are subsidiary. Social reorganization is thus the ultimate aim of scientific research, and the positivist can behold with prophetic eye humanity organized on strictly scientific principles. Cool-headed people who have had a little experience of the world recognize clearly that this ultimate goal of human intellectual activity is still afar off—that even in the lower parts of the structure there are still enormous gaps which it will require many years, and probably many generations, to fill up, and that consequently it would be folly to attempt at present to construct the higher parts. But the would-be social reformers among the Russian students are too young, too inexperienced, too impatient, and too presumptuously self-confident, to perceive this plain and simple truth. As soon as they have acquired a smattering of chemistry, physiology, and biology, they imagine themselves capable of reorganizing human society, and when they have acquired this conviction they are of course unfitted for that patient, plodding study of details which is the only foundation of genuine scientific knowledge.

To remedy these evils the government determined to introduce more discipline into the schools, and to supplant, to a certain extent, the study of natural science by the classics—that is to say, Latin and Greek. This measure naturally caused much discontent among the students. Young men who considered themselves capable of reorganizing society, and playing a political part, fretted of course under discipline, and resented being treated as schoolboys. The Latin grammar seemed to them an ingenious instrument adopted by the government for the destroying of intellectual development and the checking of political progress. Ingenious speculations about the possible organization of the working-classes and magnificent views of the future of humanity are so much pleasanter than the irregular verbs and rules of syntax.

But I must refrain from going deeper into this interesting subject. These few threads in the tangled web of Russian social history during the present reign will, I hope, enable the reader in some measure to understand how the soil was prepared for the growth of secret societies, differing widely in character and aim from those which flourished in the time of Alexander I. The contrast between the two groups is very striking. In the time of Alexander I., the members of the secret societies were all, or nearly all, young men of good family, and very many of them belonged to the *jeunesse dorée* of the period. The societies which have recently appeared are composed of very different elements. They are violently aristocratic, and draw their recruits chiefly from the sons of the clergy, the small proprietors, and the minor officials. In strong contrast to the romantic, sentimental, idyllic spirit which animated the conspirators of 1825, they declare war against romanticism in all its forms, despise sentimentality, and declare themselves the champions of the peasantry. In aims, too, they differ widely from the societies of the old school. What they desire is, to produce not merely a political, but also a fundamental social revolution, which will abolish forever all obsolete institutions, such as private property, marriage, and religion, and forever equalize rich and poor. The overthrow of the government and the annihilation of officials, nobles, and capitalists, form only the introductory part of the programme. But, for the realization of even this introductory part, great efforts are necessary. A court conspiracy, though backed by disaffection in the army, will not suffice. It is necessary that the masses should be raised from their ignorance and apathy, and made to understand what a magnificent future they have before them if they would only bestir themselves. To effect this, and at the same time to study the character of these much-talked-of and little-understood masses, intelligent Young Russia must enter for a time the ranks of the people (*idti v naród*).

Perhaps the best way of conveying an idea of this peculiar movement is to describe briefly the society which has most recently attracted public attention.

In April, 1875, a peasant, who was at the same time a factory-worker, informed the police that certain persons were distributing revolutionary pamphlets among the people of the factory where he was employed, and as a proof of what he said he produced some pamphlets which he had himself received. This led to an investigation, by which it was found that a number of young men and women, evidently belonging to the educated classes, were employed as common laborers in several factories, and were disseminating revolutionary ideas by means of pamphlets and conversation. Arrests followed, and it was soon discovered that these agitators belonged to a large secret association, which had its centre in Moscow, and local branches in Ivanovo, Tula, and Kiev. In Ivanovo, for instance—a manufacturing town about one hundred miles to the northeast of Moscow—the police found a room inhabited by three young men and four young women, all of whom, though belonging to the educated classes, had the appearance of ordinary factory-workers, prepared their own food, did with their own hands all the domestic work, and sought to avoid everything that could distinguish them from the laboring population. In the room were found two hundred and forty-five copies of revolutionary pamphlets, a considerable sum of money, a large amount of correspondence in cipher, and several forged passports.

How many members the society contained it is impossible to say, for some eluded the vigilance of the police; but many were arrested, and ultimately forty-seven were condemned. Of these, eleven were nobles, seven were sons of village priests, and the remainder belonged to the lower classes—that is to say, the small officials, burghers, and peasants. The average of the prisoners was rather less than twenty-four—the oldest being thirty-six, and the youngest under seventeen! Only five were more than twenty-five years of age, and none of these five were ringleaders. The female element was represented by no less than fifteen young persons, whose average age was under twenty-two. Two or three of these, to judge by their photographs, were of decidedly prepossessing appearance, and apparently little fitted for taking an active part in wholesale massacres, such as the society talked about organizing. It would be interesting to inquire how it has come about that there are in Russia young ladies of prepossessing appearance, respectable family, and considerable education, who are ready to enter upon wild sanguinary enterprises which inevitably lead in the long-run to the house of correction or the mines of Siberia; but I must postpone this investigation to a more convenient season. For the present, suffice it to say that there are such young ladies in Russia, and that several of them were condemned as founders and active members of the society in question.

The character and aims of the society are clearly depicted in the documentary and oral evidence produced at the trial. According to the fundamental principles, there should exist among the members absolute equality, complete mutual responsibility, and full confidence and openness with regard to the affairs of the organization. Among the conditions of admission, we find that the candidate should be willing to devote himself entirely to revolutionary activity; that he should be ready to cut all ties, whether of love or of friendship, for the good cause; that he should possess great powers of self-sacrifice and the capacity for keeping secrets; and that he should consent to become, when necessary, a common laborer in a factory. The desire to preserve absolute equality is well illustrated by the regulations regarding the administration; the office-bearers are not to be chosen by election, but all members are to be office-bearers in turn, and to be changed every month.

The ultimate aim of the society seems to have been to destroy the existing social order, and to replace it by one in which there should be no private property and no distinctions of class or wealth; or, as it is put in one place, "to found on the ruins of the social organization which at present exists the empire of the working-classes." The means by which the necessary revolution is to be effected are carefully enumerated in one of the documents seized by the authorities. Each member, it is there explained, has the greatest liberty as to the means, but he is to leave nothing undone to forward the cause of the revolution. For the guidance of the inexperienced the following means are recommended: simple conversation, dissemination of pamphlets, the exciting of discontent, the formation of organized groups, the foundation of funds and libraries. These, taken together, constitute, in the terminology of revolutionary science, "propaganda." Besides it, there should be "agitation." The difference between propaganda and agitation, we are informed, consists in this, that the former aims at enlightening the masses regarding the true nature

of the revolutionary cause, while the latter aims at exciting an individual or group to direct revolutionary activity. In time of peace "pure agitation" is to be carried on by means of organized bands, the purpose of which is to frighten the government and the privileged classes; to draw away the attention of the government from other forms of revolutionary activity; to raise the spirit of the people, and thereby render it more fit to accept revolutionary ideas; to obtain pecuniary means for the activity of the society, and to liberate those who have been imprisoned. The tendency of the bands should always be "purely socialistico-revolutionary"—whatever that may mean. In time of revolution the members should give to all movements every assistance in their power, and impress upon them "a socialistico-revolutionary character." The central administration and the local branches should form connections with publishers, and take steps to secure a regular supply of prohibited books from abroad. Such are a few characteristic extracts from a document that might fairly be called a treatise on revolutionology.

As a specimen of the revolutionary pamphlets above mentioned, I may give here a brief account of one which is well known to the political police, and figures largely at all the political trials. It is entitled "Khitraya Mekhanika" (cunning machinery), and gives a graphic picture of the ideas and method of the propaganda. The *mise en scène* is extremely simple. Two peasants, Stepán and Andrei, meet in a gin-shop, and begin to drink together. Stepán is described as good and kindly when he has to do with men of his own class, but very sharp-tongued when speaking with a foreman or director. Always ready with an answer, he can on occasion even silence an official. He has traveled all over the country, has associated with all manner of people, sees everything most clearly, and is, in short, a very remarkable man. One of his best qualities is that he is always ready to enlighten others, and he soon finds an opportunity of displaying his powers. When Andrei, a peasant of the ordinary type, proposes that they should drink another glass of *vodka*, he replies that the czar, together with the nobles and traders, bars the way to his throat. As his companion does not comprehend this metaphorical language, he explains that, if there were no czars, nobles, or traders, he could get five glasses of *vodka* for the sum which he now pays for one glass. This naturally suggests wider topics, and Stepán gives something very like a lecture. The common people, he explains, pay by far the greater part of the taxation, and at the same time do all the work: they plough the fields, build the houses and churches, work in the mills and factories, and in return for all this they are systematically robbed and beaten. And what is done with all the money that is taken from them? First of all, the czar gets nine million rubles—enough to feed half a province—and with that sum he amuses himself, has hunting-parties and feasts, eats, drinks, makes merry, and lives in stone houses. He gave liberty, it is true, to the peasant, but we know what the emancipation really was. The best land was taken away and the taxes were increased, lest the *muzhik* should get fat and lazy. The czar is himself the richest landed proprietor and manufacturer in the country. He not only robs us as much as he pleases, but he has sold into slavery (by forming a national debt) our children and grandchildren. He takes our sons as soldiers, shuts them up in barracks, so that they should not see their brother-peasants, and hardens their hearts, so that they become wild beasts ready to tear their own parents. The nobles and traders likewise rob the poor peasant. In short, all the upper classes have invented a cunning bit of machinery by which the peasant is made to pay for all their pleasures and luxuries. But the people will one day arise and break this machinery to pieces. When that day arrives, they must break every part of it, for if one bit escapes destruction all the other parts will immediately grow up again. All the force is on the side of the peasants, if they only knew how to use it. Knowledge they will get in time. They will then destroy the machine, and perceive that the only real remedy for all social evils is fraternity. People should live like brothers, having no *mine* and *thine*, but all things in common. When we have created fraternity, there will be no riches and no thieves, but right and righteousness without end. In conclusion, Stepán addresses a word to "the torturers:" "When the people shall rise, the czar will send troops against us, and the nobles and capitalists will stake their last ruble on the result. If they do not succeed, let them expect no quarter from us. They may conquer us once or twice, but we shall at last get our own, for there is no power that can withstand the whole people. Then we shall cleanse the country of our persecutors, and establish a brotherhood in which there shall be no *mine* and *thine*, but all will work for the common weal. We will construct no cunning machinery, but will pluck up evil by the roots and establish eternal justice."

It would be interesting to trace the connection between these secret revolutionary societies and the great intellectual movement which took place in the educated classes after the Crimean War, and produced the beneficent reforms of the present reign. Want of space prevents me from entering on that investigation. All I can say for the present on this subject is, that these societies are the illegitimate and monstrous progeny of that movement. Many of the agitators claim to be disciples of Tchernishefski—a man who held the most influential position in Russian periodical literature during the time of the emancipation, and who was afterward exiled to Siberia, where he is still living—but I venture to think that he could not recognize them as such, and I am quite certain that he could have no sympathy with those specimens of the class whom I have seen. If we accept a novel which he wrote while in solitary confinement, and which cannot fairly be considered an exposition of his real views in his serious moments, we find everywhere in his writings a large amount of common-sense and moderation. In the conversation of the few agitators whom I have met I have always found the reverse—a strange farrago of pedantry, childishness, and political fanaticism. Not long ago I was favored with a visit from one of these gentlemen. During several hours I listened attentively to his tirades, and endeavored, immediately after his departure, to put on paper what I had heard; but I must confess that, though not without considerable practice in that kind of work, I failed completely. Beyond the ordinary stereotyped phrases about tyranny, obscurantism, "the cursed bourgeoisie," "exploitation" of the peasantry, and the like, I could recall nothing. My visitor spoke Russian during the interview, but his dissertations were interlarded with Russified-French words, showing plainly the source of his inspiration. Such men do a grievous wrong to the man whom they call their teacher, and whom they profess to revere; for the authorities, though disposed to clemency, think that they cannot safely liberate one whose name is used as a watchword by unscrupulous political fanatics. This is, no doubt, a grave consideration; but I think that more importance is attached to it than it deserves. Surely, at the present moment, when so much is said about justice and humanitarianism, the government might do a graceful and politic act by liberating a man who unquestionably did good service in the cause of serf-emancipation, who systematically discountenanced all foolish political demonstrations, and who has more than expiated, during fifteen years, any youthful indiscretions he may have committed.

A few words in conclusion regarding the real importance of these secret societies. Do they constitute a real danger for the state? Any one who knows Russia well will not hesitate, I believe, to answer this question in the negative. Even some of the agitators have come to perceive the folly of their conduct. Here is the literal translation of a letter written by a member of the secret society above described. I preserve, as very characteristic of the movement in general, the pedantic, pseudo-scientific style in which the document is written. Referring to the impetuous, inconsiderate conduct of one of the female members of the society, the writer says:

"I explain her conduct by her complete subjection to the desire of acting in a certain direction without thinking of consequences, and by the want of critical power or perhaps by the desire not to consider the thing critically. We ought at last to look into the past and learn from experience. It is time for us to give up running our heads against a stone-wall. She wishes to act in a 'rude,' 'democratic' sphere, but she forgets that if she now gives way to her impulse, she will be again within a month in prison, and she will thereby deprive herself of all possibility of ever doing anything. Further, such impulsive action at the present time, when so many people are in prison, is a bit of extreme egotism and a giving way to personal feeling. All the authorities are now alarmed and on the watch. Their nervous system and their feeling of revenge are excited. Their fears are exaggerated. Every new attempt of the kind will not only be quickly discovered and end in the ruin of those engaged in it, but it will at the same time strengthen and keep up the present excitement among the authorities, and make them act more energetically against those who have fallen into their hands. Is it not, then, extremely egotistical to give way to personal feeling, and to disregard the fate of hundreds who will suffer in consequence? Besides this, it will greatly injure the people by calling forth a series of repressive measures which have a prejudicial influence on the national life. That is the more evident side of the question. But there is another side which may be called the principal one. Are all problems solved accurately so as to admit of no doubt? Surely experience is not altogether silent. What is the people? Not only are the problems not solved, but they are not accurately stated. Experience must lead to doubt. The thing is that Russian radicalism is merely an abstract logical conclusion, founded on an untrustworthy basis of sentiment and an ignorance of the

nature and wants of the Russian people—ignorance of the conditions of itshistorical life and of man in general. So long as that specially practical and partly theoretical information has not been obtained, it is impossible to arrive at any conclusion, and still more impossible to begin any activity. That Russian radicalism does not know man in general and the Russian in particular—that is unquestionable. We know by experience that it wishes to impose on Russians foreign modes of thought and ideals which they are incapable of appropriating. It promises them a stork in heaven, when they would much prefer a sparrow on earth. By *a priori* reasoning and from general knowledge of human nature, we may conclude that every ignorant and 'undeveloped' man values most of all his own life, that the sphere of his requirements is confined to food and a wife, and that anything higher than these is unintelligible for him until they are satisfied, and until you develop in him human dignity and thought. Besides this, various social misfortunes have brought down the wants of the Russian peasant to such a minimum, that, firstly, it requires very great want to make him protest, and, secondly, it requires very small concessions to make him be silent and tranquil. If the apparent emancipation of the serfs postponed popular insurrection for several decades, it is evident that when serious attempts at insurrection are made in the future, it will be sufficient to diminish the taxes and increase a little the amount of peasant land. Small material concessions will induce them the more readily to deliver up the leaders and intelligent propagandists, and that will continue until there have been created in the people a popular idea and more or less human culture, which must be created not by books imported from abroad, not by incitement to revolt, but by gradual human development, and by influence in those places where it is not completely excluded by unfavorable circumstances. The times of Pugatcheff are past. The state has succeeded in crushing the warlike, nomadic instincts of the people. A popular rising has, therefore, no chance of success, and if such a thing did happen to succeed, the people in its present intellectual condition would gain nothing, and would simply fall into the hands of a dictator, or of capitalists, or of both. I do not deny the possibility of an insurrection as the result of a whole series of causes, but I am convinced that it can be produced and guided only by elemental forces independently of artificial influences. He who can raise the spirit of such a popular movement and take advantage of it will alone gain by it, and his success or failure, so far as the people are concerned, will depend on the degree of conscientiousness of the leaders; for a popular revolution is an elemental force, and not a principle, or a logical conclusion, or a mathematical programme. Hence to raise *Revolutionarity* (*Revolutionnost*) to the rank of a principle is in my opinion an absurdity. Revolutionarity can exist only in the feelings of an individual man or in the periodical outbursts of the masses. The masses as an element do not possess the critical faculty, and at certain moments act by instinct. The individual is obliged to act according to the critical faculty, and ought not to construct his principles on elemental impulsions of the masses. Regarding the latter as an historical and cultural necessity, he ought to content himself with the following programme: by the attentive study of the masses and of the separate units of which they are composed, he should inoculate the separate units with consciousness and the critical faculty, avoiding all bias and instigation, and introduce into the masses, in so far as it is possible, the elements of human culture. The rest should be left to the elaboration of this material by the people. Further than this the part of intelligent units cannot go. Every departure from this, so to say, natural programme, is as fatal to the intelligent units and to the people as every departure from the laws of Nature must be. Revolutionarity as a principle is an anomaly—a transferring of instinct to the sphere of logic, that is to say, an unnatural union. But all that is general theory. There are no actors, and those who remain should spare themselves. Such a miserably small group cannot do anything more in the direction which I regard as the true one. It ought therefore to contract itself so as to form the nucleus of a future radical party, and in the mean time it ought to examine the surroundings in which it lives, study these surroundings and the people, investigate the conditions and organization of civilized life, elaborate the foundation of a programme, increase as much as possible the number of conscious and reflecting adepts—not of children—and wait. Every revolutionary pamphlet should be thrown into the fire. All that is nonsense and absurdity. Perhaps the time will soon come when it will be necessary to have a conscious—radical—popular party, a genuine champion of popular interests—not a mere phantom in the form of an anachronism; and such a party will not then be found. It is necessary to create it, and in the mean time to wait, working slowly but surely in that direction. It is time to get rid of the charms of peasant surroundings, and to give up thinking about externals. These youthful outbursts without criticism lead to nothing but harm."

Let us hope that Young Russia will soon come to perceive clearly the truth contained in the last sentence of this curious document.—*Fortnightly Review.*

THE CONDITIONS OF LIFE IN ANIMATED BEINGS.[1]

By EMILE BLANCHARD.

THE conditions of existence to which beings are subject present a prodigious variety, in harmony with the diversity of animal forms. In fact, between the organization of beings and the peculiarities of their abodes, their aptitudes, habits, instincts, and intelligence, there are close relations which call for deep study, and after study for meditation. We feel that such study is the certain path leading to the true interpretation of most of the phenomena of life, and to sound ideas of the plan of creation. The possibility of dwelling with advantage on such a subject dates but from yesterday, as it were; it could only come after the great number of scientific investigations that have been followed up to our epoch. It is useful, then, to present a rapid sketch of the phases through which the subject has passed before the views which we desire to explain were brought out.

In every country, among primitive races as well as in civilized nations, the most careless attention to the animated world allowed men to recognize certain conditions of existence imposed by Nature upon the various representatives of creation. While the most striking characteristics, the most singular features of organization, remained unnoticed by superficial observers, the main aptitudes and the places of abode of the most widely-spread races escaped no one. The earliest men observed that there were creatures in some sort attached to the earth, others gifted with the power of moving in air, others again designed for living in water. Terrestrial, aërial, aquatic animals, these are the only distinctions known without some degree of attentive remark. In looking upon Nature, nothing strikes the human mind more forcibly than the circumstances of life.

That almost childish thought which forms the notion of important relations between the most dissimilar beings, if there exists some resemblance in certain faculties and in the abode, is so deeply rooted that it persists even against ideas quite sufficient to compel its surrender. Instances are numerous. Formerly, in the eyes of all who looked with a sort of superstitious terror at the rapid wheeling flight by night of bats, these creatures, having the power of flying, must be birds. At a time when a great amount of scientific knowledge had been already gained, the ignorant were not the only ones to follow that opinion. Bats have a body covered with hair; they have teeth; they produce their young alive, and suckle them; in a word, they combine all the essential marks of land-animals usually denoted by the name of quadrupeds. Men acquainted with these facts by observation nevertheless continue, like the ignorant, to see in bats birds of a singular form, or at least beings that share in the nature of birds and quadrupeds both. In the sixteenth century, Belon, the naturalist-traveler, and Scaliger, the famous scholar, contented themselves with this sort of judgment. An opinion as ill-founded is much more strongly expressed even now, with regard to dolphins and whales; the obstinacy with which these inhabitants of the deep are regarded as fishes yields most reluctantly to an exact conception of the most characteristic traits in their organization. As there was united with this condition of a common abode for dolphins and fish a considerable resemblance in their bodily form, the truth was only admitted after long resistance. It was known that dolphins and whales are warm-blooded animals, while fish are cold-blooded; that the former breathe in the air, the latter in the water, and that the former are true mammals, yielding milk; in spite of all, it was supposed that whales and dolphins, living in the water, could not possibly be anything else than fish.

If attention dwells at first most readily on conditions of abode, it is afterward caught by striking aptitudes. The construction of the swan and other birds of the same family, so happily adapted to their mode of swimming, has always been admired, even though not studied. With no greater effort of reflection, it was remarked that fishes, in the shape of their bodies and their fins, unite those conditions most favorable for movement in the water. There was no need of investigation to discover that the wings of the insect and the bird are the very instruments that allow these animals to support themselves in the air, and to pass over more or less considerable spaces. In all ages wings have been an object of envy for men—an ideal. Angels exist in imagination, and these heavenly beings with human forms wear wings. To soar in a few seconds to great heights, to sweep swiftly over vast expanses,

[1] Translated from the *Revue des Deux Mondes*, by A. R. Macdonough, Jr.

to withdraw almost instantaneously from those one wishes to shun, to drop suddenly upon certain places, and discover in them some hidden or lovely thing—such are the longings that have agitated many hearts.

A few of the general features of Nature have necessarily been visible at all times to the eyes of men least disposed to launch into high speculations, but nothing has been understood. Those who first conceived the thought of writing the history of animals remained under the control of prevailing ideas, and stopped at appearances, which are enough to content the mind of mere observers; but the day came when naturalists thought of arranging a sort of inventory of Nature. Then, from the necessity of giving a description of each animal such as to cause it to be recognized, grew the attention needed for grasping those peculiarities of conformation common to a greater or less number of species, without paying much regard thenceforward to their kind of life. It began to be perceived that creatures very similar in their characteristic organization might have very different habits and modes of nutrition. Yet with this glimpse of truth men were still far from having a clear conception of the typical forms to which animated beings are bound. Thus it was an event when George Cuvier, more learned than his predecessors, discovered that "there exist four principal forms after which all animals appear to have been modeled." This new light soon gained all imaginable brightness from the observations of a professor at St. Petersburg, laboring and meditating with no concern for the opinions more or less in vogue. It had occurred to that patient and skillful investigator to prove that the characteristics of beings in their embryonic condition confirmed the natural divisions observed by Cuvier, which only required to be corrected as to their boundaries. In another direction, fortunate suggestions, springing up in the early years of our century, directed investigation upon a course peculiarly favorable to the advance of science. Comparisons methodically made established the certainty that all the representatives of each of the grand zoological types are constructed after one and the same fundamental plan, that the differences relate simply to the configuration of the parts, to their degree of development or perfection, to their appropriation to various uses; an admirable truth, disengaged by slow degrees from obscurity, and afterward defended against ancient errors with a sort of enthusiasm kindled by the feeling of winning a great controversy for the human mind. With a success checkered, however, by a few failures, owing to the want as yet of sufficient precise knowledge, proofs were constantly accumulated that all vertebrated animals, mammals, birds, reptiles, fishes, have the same organs situated in constant relations, and that all articulated animals, insects, arachnids, crustacea, are derived from one single primordial plan. As to the vertebrates, this demonstration came in great part from the labors of Geoffroy Saint-Hilaire; as to the articulates, it was made by Savigny.

Setting out from this point, it became almost easy to understand the reason of the form or the degree of development of different parts in the organism, and to gain the meaning of an alteration in the forms. A guide of unerring certainty was given to investigators. Under the influence of the very natural exultation occasioned by the triumphs gained, and yet more by the grand and philosophic idea which had ruled in the investigation of parts of like nature, or, to adopt the expression used, of homologous parts in animals so unlike as fishes, reptiles, and mammals, the question was asked, whether unity of composition did not extend throughout the entire animal kingdom. Thus several attempts were made, but not successfully, to assimilate the organs of the insect to those of the vertebrate animal. In these two types the organs do not maintain either like relations or like positions; it is only by giving exclusive attention to marks of structure and to the function of the parts that we find it possible to reach a sort of assimilation.

The precise idea of the general constitution of animals having become established, anatomical studies, suitably directed, ceased to find their only object in the configuration of the organs; they tended necessarily toward the interpretation of modifications in the organism, the ascertainment of the functions of parts, and the discovery of the mechanism of arrangements. The results gained under the inspiration of such views are vast, and science has enlarged with marvelous rapidity. On the other hand, close study of the tissues has brought to light this important fact, that the primitive elements present the same essential characters in all living beings. By experiments skillfully conducted upon living animals, certain functions of different parts of the organism have been made apparent which doubtless would never have been suspected had other modes of examination been employed. Investigations of the successive phases of develop-

ment in animals, demonstrating identity of origin for all, revealing the most curious details upon the changes that occur in the organs, and in the conditions of existence of a multitude of species, making the most instructive comparisons between the permanent and the transitory states of an immense number of creatures, have greatly enlarged the horizon of philosophy.

Thus we have reached an epoch in which science, rich in solidly-established truths, has assumed a character of remarkable grandeur. Aided by the very various methods which investigators have employed, we are certain of yet making great and numerous discoveries, of completing many branches of knowledge that remain imperfect, and of attaining new generalizations; but a different view is coming into notice of those which have hitherto served as guides to naturalists, promising to carry our resources to the highest degree of availability in the examination of the phenomena of life. Although by itself alone the comparative study of apparatus may fail to enlighten us as to the object of certain modifications, or to explain the reasons for various changes in forms, in arrangements, in the excessive development or the atrophy of certain parts, and although experimental research, in its turn, owing to the necessity that confines its action within rather narrow limits, may also become impotent, yet the resources of the scientific spirit will not be exhausted. There will still remain to be followed that which we may call experimenting on Nature. In a word, the solution of the highest problems of natural history must be looked for in the constant observation of the coincidences between all the details of organization and the vital conditions in the case of each animal. Nothing exists in the organism, it seems, without having some duty to perform. To this rule we perhaps find a single exception: certain parts, dependent on the teguments which are strongly developed in males and wanting in their females, are probably nothing more than ornaments.

No zoölogist of the present day takes conformity of abode and of aptitude as an assured sign of essential resemblances; and yet, in consequence of the tendency we have remarked, this sometimes leads to serious mistakes in judgment. One of the most wonderful things in Nature is the extreme diversity gained from a common stock—a diversity which displays itself, in the case of living beings, both in their characteristics and in the circumstances of their lives. A variability in conditions of existence which is often wide in species of the same natural group, a sort of repetition of similar conditions in species of groups more or less unlike, carry this diversity to the farthest imaginable limits. Hence come special applications of important characteristics in the organism.

The idea of the relation existing between peculiarities of conformation and the kind of life will be made more precise by an instance readily understood. Every one has heard of those distinctions between granivorous and insectivorous birds that belong to a science now obsolete. The sparrow, the chaffinch, and goldfinch, are thought to be granivorous; the warbler and wagtail are classed as insectivorous, notwithstanding their mode of feeding, which is less exclusive than was once supposed. All these birds show absolutely the same general structure; those marks which are distinctive at a glance, as the shape of the beak, are quite of a secondary order, and merely denote adaptation to biological circumstances very slightly different. Other species of birds, which are almost sisters in their habits, yet of remotely separate origin as regards their general organization, present certain superficial traits of resemblance that easily mislead observers disposed to trust to appearances. Every one knows the difference between little swallows—the window-swallow, the chimney-swallow, the bank-swallow, and the great swallow, or martin—but every one also, including many naturalists, is convinced that all these birds, called by one and the same name, belong to the same family. Yet this is not so at all; the little swallows have the conformation of sparrows, and their adaptation to a rather peculiar kind of life is almost all that makes the difference. The great swallow is constructed in an altogether different way, and shows a remarkable affinity with those charming birds of Southern America called humming-birds. Both little swallows and great swallows, representatives of separate and strongly-characterized types, feed alike on insects which they snap up on the wing; then, too, they are alike in having a small beak, broad at the base and cleft down to below the eyes; intended alike to sweep through the air swiftly and to traverse great spaces, they are similar in having the quill-feathers of their wings extraordinarily long. Thus, the species of a great number of natural groups, offering greater or less dissimilarity in their kind of life, are remarked for very evident peculiarities, though of a secondary order, which fit them properly for fixed conditions of existence. Therefore, species of groups that are wholly distinct may resemble

each other in some superficial marks, certain signs of adaptations to a similar sort of food, or similar habits. The study of beings pursued in a comparative way in all the details of their organization and all the acts of their life, this alone can safely lead us to the distinction between what is general and what is particular, and, as the highest end, to an understanding of the great laws of Nature. The path is barely marked out, and we see in perspective the endless range of triumphs that will successively enlarge the realm of science. If we were obliged to limit ourselves to weighing the relations between the organism and the circumstances of life, acquiring certainty with regard to the habits of an animal before direct observation from considering its conformation only, or with regard to organic peculiarities from considering its recognized aptitudes, even with this restriction, the result would be very satisfactory. But above this result there rises the question of instincts, intelligence, and feeling, in their relations to the organism—psychology, resting on facts capable of demonstration through observation, experiment, and comparison, that precious source of light.

In this order of ideas we have to concern ourselves with facts which will find their explanation in the views of most recent science, and with subjects which for their full comprehension require investigations of a new kind. In a field so vast, we must necessarily dwell on only a small number of instances, chosen among the most instructive and striking ones, and neglect matters of commonplace science. It would be of little use to trouble ourselves about limbs turned into oars for swimming, and wings for flying, or about teeth adapted to the food and the appetite, since such instances are but the common citations by which naturalists display their powers of inference. In this study, which must be restricted in its range, we shall not adduce man as an instance, nor point out in his case such coincidences as those we intend to examine in the case of various animals. For the sake of a term of comparison, it will be enough to say that man, endowed with intelligence far superior to that of all other creatures, possesses equally marked physical advantages in the posture of his body and the shape of his hand, that incomparable natural instrument. The instrument being given, instinct and intelligence must be given, sufficient to put it to use, and to draw all the advantage possible from it. This is an absolutely general truth, which will certainly result with irresistible conviction from observation, and particularly from the comparison of facts—a truth which must be kept constantly before our eyes.

As we intend, in the first place, to examine some animals of different classes remarkable for their peculiarities of external conformation and at the same time for their special aptitudes, it seems well to call attention to a very curious mammal, the aye-aye, or chiromys, of Madagascar.

After having traversed China and the East Indies during the years from 1774 to 1780, Sonnerat, a French traveler, landed on the western shores of that great region of Madagascar, so interesting for its natural productions. The natives brought him an animal the size of a cat, covered with a thick fleece; it was the first time they had seen it themselves, and they expressed their surprise by repeating the sound *aye-aye*. Sonnerat, as much struck with amazement as the Malgaches were, attempted in vain to connect this mammal with some known type; he found resemblances in its physiognomy to squirrels, makis, and monkeys, all together. By a singular whim, the naturalist-traveler named the curious animal by the exclamation that had struck his ear so forcibly, and the name has been preserved.

The aye-aye, which displays its activity only during the night, has great, rounded eyes, like those of hooting and screech owls. It is peaceable and timid, sleeping all day with its head hidden between its legs, and the tail curled underneath. To these traits it adds one thing more extraordinary and altogether unique: the two fore-feet, which resemble a little the monkey's hand, have the fingers rather thick and covered with hair; one of these fingers, the middle one, is bare, quite slender, and possessed of the power of lifting itself and acting quite independently of the others; it seems like a deformity. In this point there is displayed in a striking manner a relation between a detail of shape, peculiar conditions of existence, and a very special instinct. Sonnerat kept a male and female alive for two months, feeding them on boiled rice, with which they contented themselves for want of anything better, and, doubtless, to the injury of their health. Our traveler relates that they used their two slender fingers in eating, as the Chinese use chopsticks. This remark would not have thrown much light on the true use of this slender finger, if we were not better informed by statements gained from the natives of Madagascar, and lately by the observations of travelers. The aye-aye lives partly on insects, choosing the plumpest and most delicate—the larvæ that live in the trunks

and branches of trees. Often these trees have fissures, and it is possible to reach the larvæ which bore them, and pull them out from their holes; but the openings, being narrow, allow only a very slender instrument to pass. The aye-aye has its taper finger for an instrument. The animal must necessarily have at its disposal senses, an instinct, an intelligence, fit to lead it to the designed object. In fact, it has eyes with an extremely dilatable pupil, which amply admits the faint twilight or moonlight, and allows it to roam the forests at night without the least difficulty. It has ears that indicate great delicacy of hearing, and beyond doubt it detects the slight noise made by the larvæ in gnawing the wood. It brings an astonishing intelligence to the demands of its pursuit; it may be seen striking a trunk or branch of a tree with its nail — in a word, availing itself of percussion to learn whether a hollow exists that may contain a grub. Possessing a keen scent, the aye-aye satisfies itself of the quality of its food. Dr. Vinson, to whom we owe interesting observations on the animals of the island of Madagascar, relates that an aye-aye in captivity would not accept all grubs indifferently, and distinguished between them by smelling. This curious mammal, related to the makis by its general characteristics, has a dental system similar to that of gnawing animals. Fond of those tropical fruits that are full of savory pulp, it bites through their hard shell with its strong incisors, introduces its slender finger through the opening thus made, and, bringing its mouth near the orifice, draws the pulpy substance out. When one hand is tired it uses the other.

Can we find a creature better fitted for living in conditions strictly determined, or corresponding more completely in singularity of habits with its singularities of conformation? The famous English naturalist, Richard Owen, author of an excellent essay on the chiromys of Madagascar, finds in it strong arguments in refutation of ideas too readily accepted as to the mutability of species. By its zoölogical characteristics, the aye-aye is an isolated being in creation; like the makis, its nearest relatives, it inhabits forests in which insects everywhere abound. Nothing would compel it, any more than other animals of the same group, to prefer those kinds that are hidden in the trunks of trees, unless a peculiar distinction, related to peculiar instincts and organs, had been assigned to it from the beginning. Is there the least reason to suppose that the tapering of one finger on the fore-extremities has been produced through a forced use by individuals in a succession of generations, when they had no need of subjecting themselves to that trouble to find food in abundance?

The digging animals, intended for an underground life, are well known in respect to their characters and instincts, which are in a manner repeated in the most different types. Every one notices their body, tolerably long and nearly cylindrical, their short, broad, and extremely powerful fore-limbs. Observe the mole: its body presents no prominent part capable of obstructing easy circulation in narrow galleries; its fore-feet resemble strong hands, with the palm turned outward, and with broad, sharp nails. Could one imagine instruments more perfectly adapted to break up and push away the earth? The animal's muzzle, made resistant by the presence of a special bone, is a snout, acting like a gimlet. To these peculiarities, which explain the mole's manner of life so well, are added senses developed to a degree that corresponds with the conditions of existence of this mammal. Organs of sight are useless to a being condemned to live in darkness; and these are rudimentary. A very delicate touch is indispensable to their recognition of each other in their dark abodes; it is given by the muzzle, which is nearly bare, having some stiff, scattered hairs. In a contracted space, to be warned of a danger, or of the presence of insects that form its prey, it is important that it should be sensitive to the least sounds; its organs of hearing answer that requirement. In the absence of sight, a very keen sense of smell is of the first necessity, to guide it in the search for food; and its olfactory organ is greatly developed. An organization and instincts so well adapted to an underground life make existence impossible for the mole in any other conditions.

In a certain insect there are found peculiarities of form, habits, and instincts, so similar to those of the mole, that the insect, after the popular idea, has been called the mole-cricket. It has an almost cylindrical body, its fore-claws pressed close toward the head, with legs prodigiously large, and provided with strong serrations, so as to bear a kind of resemblance to the feet of the mole. The legs of the mole-cricket and the feet of the mole are organs of entirely different nature, marked by an almost identical adaptation.

There are animals which, among those of the same class or family, present nothing more unusual than some particularity which seems to be trifling. When the reason for this insignificant peculiarity is found, a strong interest arises.

Birds of the family of our cuckoo, spread throughout the warm regions of Africa, Asia, and Australia, known under the name of "coucals," will give us an instance of this. We know how flexible and soft to the touch are the beards of the feathers in the wings and tail of birds in general. In these birds, on the contrary, they are stiff and harsh like thorns. Without close observation, much vain inquiry might have been spent as to the necessity which this structure of the feathers corresponded to; but we had the notices of travelers, and perceived at once a wonderful adaptation. These birds live in gloomy forests, and feed on insects, which they are obliged to pursue in the thickets of vines twining about the trees. These vines are extremely tough; the ordinary plumage of birds would be torn and cut to pieces by the contact, but the feathers of the coucals resist it.

If we chose to pass in review the species of birds, as to each one of them we should find in the details of formation of the claws the signs of certain habits easy to prove—in the shape and development of the bill the mark of a preference for some special kind of food. On this subject a great number of curious observations are recorded which it is impossible for us to relate. But here is one instance, taken almost at random from among many others, of a very singular beak, adapted to a very special kind of food, which seems too instructive to be passed by. Every one knows the crossbill, that prettily-feathered bird which frequents forests of evergreen trees and fir-plantations; its beak has the mandibles very much arched in opposite directions, and crossed for about two-thirds of their length. One needs to see the bird provided with this strange beak breaking and peeling the resinous cones, to admire the usefulness of such an implement. A very simple modification sufficed to create the instrument with which it attacks the pine-cones, and this sort of anomaly is produced only at a late period in the animal's development. Is there not here a fit subject to induce those naturalists who have faith in the mutability of species to try a little experiment? It would merely be a matter of shutting up a few crossbills in an inclosure and depriving them of their usual food while supplying them an abundance of the food sought by granivorous birds. Either the crossbills would perish without breeding, or, as a result of their new food, after a few generations their beak would have changed its shape and taken another, better suited to a different kind of life. If the experiment should succeed, our bird of the fir-groves would not yet have become a common sparrow or an ordinary grossbeak, but at least the theory that has made so much noise would have gained one serious argument.

Among fishes there are some kinds that seize their prey in front of them, and even out of water, and other kinds that seek their food in muddy bottoms. With the first, as the perch, the lower jaw projects beyond the upper; with the latter the contrary is the case; the mouth is crowded downward, and is often provided with fleshy appendages fitted to stir up the mud: the barbel is an instance of this. Thus everywhere some characteristic points out habits and instincts from which the animal cannot disengage itself.

With respect to insects and arachnids, the study of coincidences between their ways and their peculiarities of outward form has been carried very far. The examination of the working-tools in species fitted to build suffices now to give us a certain conclusion as to the kind of work the species performs. By the study of the appendages we know in what way and under what conditions the animal must move. In a great variety of circumstances, from the arrangement of the organs of sight, we infer, without fear of mistake, the existence of wandering or of sedentary habits, with a multitude of fine distinctions. At the same time, with insects and arachnids we follow step by step, better, perhaps, than in any other case, the advance in instinct and intelligence with the growing perfection of the instruments, as also the diminishing of these faculties along with the simplification of the appendages.

A different condition of abode from that usually presented to our notice offers considerable interest with regard to the adaptation of organisms to the media, and to the question of the origin of beings. Animals of different classes live in places wholly deprived of light; these animals are blind. Just a century ago there was discovered in the subterranean waters of Lower Carniola a sort of batrachian of pretty large size, from eleven to thirteen inches long, of a pinkish white, having external branchiæ—in a word, resembling, with larger proportions, the larva of a triton or a water-salamander. The animal was blind; a zoölogist introduced it by the name of the "serpentine proteus." The first conjecture was that this batrachian was carried into the caverns by water overflowing in the rainy season from the Sittich lakes; but this supposition was not found correct. The proteus has never been

taken except in subterranean waters, and it is now always easily found in the grotto of Adelsberg, situated on the road from Vienna to Trieste. Here, then, is a species of a peculiar kind, very distinct from all others existing in Europe, and living in an habitual way in darkness. In Kentucky, in the United States, there is a deep cavern, the Mammoth Cave, abundantly supplied with water. No light penetrates it; the darkness is utter. A fish inhabits the water of the cavern, in which necessarily other animals live, and vegetables to give them nourishment. The fish is whitish, without scales, of a kind that has never been found elsewhere, and entirely blind; its eyes, in the rudimentary state, and hidden under the skin, are quite useless; its apparatus of hearing, on the contrary, is well developed. This Kentucky fish has been named the "cave amblyopsis, the generic name referring to the animal's blindness. The amblyopsis presents in its general conformation characters so peculiar that the authors who have studied it best have not been able to refer it with certainty to any of the known animals of the class of fishes. Some zoölogists, perhaps rightly, see in it the type of a new family. Louis Agassiz, an authoritative judge upon the question, maintaining extreme caution, only declares that he inclines to consider it an aberrant form of the family of cyprinodontes. The habitation of the amblyopsis is extraordinary, and its characteristics are not less peculiar. Among all the fishes there is neither species, nor genus, nor even family, in which a true relationship can be found for it. In view of these facts, it would be difficult to maintain that the fish of the Mammoth Cave was not created to live in the unique condition in which it has been found by naturalists.

At a not very remote period an entomologist of Germany undertook a careful exploration of the grottoes of Carniola, and discovered in them certain blind coleoptera, very active, quite colorless, wan, almost transparent, having a size of from two to three inches in length, and remarkably elegant proportions. These insects did not closely resemble any known form; they were described under the name of "anophthalms," to express their most striking mark, the want of eyes. The fact long continued an isolated one, but within a few years examinations actively carried on in the grottoes of the Ariége, the Pyrenees, and different parts of Europe and North America, have resulted in the discovery of many distinct species belonging to the same genus. The hunt for these anophthalms would not be a pleasant one for everybody. Fortunately, entomologists are people determined to brave difficult situations and suffer many inconveniences to attain their object. They enter these caverns with torches, and advance slipping over the rough, wet floor, striking against rocks, and wounding themselves on jagged points. Near the entrance of a cavern, where the darkness is not yet complete, a kind of anophthalm is sometimes found, which has imperfect eyes, but it is necessary to go still farther to find those lively blind coleoptera they are in search of. Almost always the seeker finds these insects over a rather limited space, running along the walls of the cave or hidden under the stones. At present the known anophthalms are numerous, and—a fact worthy of remark—each species seems limited to a single cave, or to a few caves only a little distance apart. If the seekers of blind insects were merely animated by the wish to take strange species and adorn their collections with them, they have none the less done science a useful service by gathering materials that lead to reflections on the conditions of existence in some beings. In their zoölogical marks the anophthalms have close relations to the coleoptera of the same family that live in the light; but they have forms and proportions so peculiarly their own that the idea of a common origin could not enter the mind of any naturalist. The species observed in different caves and under similar conditions are perfectly distinct, and when we find in the greater part of them complete atrophy, not merely of the eyes but also of the optic nerves, it is hard to believe in anything else than an adaptation of the organism to a special kind of life.

Besides, in the darkness of caverns and deep grottoes there are animals of more than one kind; we find there small crawfish, small spiders, insects of different kinds, all wanting the organs of sight. There are in those gloomy recesses vegetable-eating species, serving in a certain degree for food to the carnivora; and vegetables, some kinds of mushrooms, the only known plants susceptible of growth in the absence of light, designed to feed such species; it is a complete little world set apart from the rest of the world. The broken chasms of a grotto, besides being the most picturesque retreat, are the abode of numberless creatures that pursue, retreat, destroy, and move, in a constant whirl.

Who could resist the temptation of seeking to ascend in thought toward the origin of these sightless creatures, to whom existence seems so wretched? Agassiz was asked to give his opinion

upon the primitive condition of the eyeless animals of the Mammoth Cave. The eminent zöologist declared the necessity of a series of observations and experiments to arrive at absolute certainty. He advised the attempt to rear the embryos of the cave-species by subjecting them to different conditions from those in which they are now found; and he ended with this declaration: "According to all that I know of the geographical distribution of animals, I am satisfied that these were created in the circumstances in which they are now living, within the limits where they are now found, and with the same peculiarities of structure that mark them to-day." Only those who refuse to deal with the observation of facts can be easily led to believe that the inhabitants of caverns—fish, insects, or other animals—are blind because they live and breed constantly amid circumstances in which the organ of sight could not do its duty. That supposition is really not inadmissible, according to the laws of organic development; an atrophy may be produced under certain influences; but a knowledge of the conditions of life rigidly fixed for animals in general compels us to reject such an explanation as that with regard to the cave-species. There is almost an absolute certainty that species designed to see the day would perish, or cease to breed, if they were confined in an atmosphere laden with moisture, and plunged in utter darkness. Since the date of Agassiz's expressed opinion, these sightless species have been collected in great numbers, and observations repeated, and on one point of the highest importance doubt is no longer possible; the animals of these dark recesses are not found in spots exposed to light, and many of them differ so strikingly in their characteristics from species which see as to destroy any notion of community with them in origin.

After the instances of adaptation of external parts to fixed conditions of existence, we should examine in what way the parts of internal organization explain special aptitudes. In this regard, the absolutely precise facts we possess are not yet so numerous as might be wished, but there is reason to expect a great deal from the investigations that are going on in our time.

In 1853, the first living hippopotamus seen in Europe since the time of the Romans was introduced into the menagerie of the Museum of Natural History at Paris. It was an event, and every one was delighted in watching the singular ways of the animal, of which the pictures and descriptions and stuffed figures had given no correct idea. The new guest at the Jardin des Plantes often plunged into his bath, and reappeared at the surface almost immediately; but several times the animal made so long a stay at the bottom of his basin, that more than once it caused uneasiness. As it was not understood how a mammal of that order could have the power of breathing at very long intervals, suffocation seemed possible. But all anxiety ceased when the conviction was gained that the hippopotamus staid at the bottom of the water because it was his pleasure to do so, and after that there was no longer any doubt that it possessed some organic arrangements fitted for an amphibious animal. An opportunity of studying them came later. The first hippopotamus was a male; a female arrived, and they produced offspring. Several of the young died, and Gratiolet, whose eloquent lectures have charmed so many audiences, devoted an attentive examination to them. That examination supplied the explanation why it is that suffocation would occur in the hippopotamus only after a very long suspension of respiration. Several remarkable arrangements of the veins force the blood to accumulate and pause, not to rush suddenly to the heart, nor to return in a great quantity to the lungs. Thus the animal, protected against the danger of congestion of the brain, the eyes, the lungs, and even the muscles, preserves its freedom of movement.

Bats, and those pretty little paroquets called *inseparables*, from the notion of the mutual affection these charming birds require, the *agapornis* of zoölogists, suspend themselves by their claws, and sleep head down. In that position most animals would suffer congestion of the brain. Such an accident need not be feared either for bats or for paroquets. We understand how so unusual a position is possible for these animals, as soon as we remark the number and arrangement of the little valves in the veins of the head and the fore-parts of the body. The immense difference that exists between birds as to their power and rapidity of flight is well known. The pheasant and partridge have a short and heavy flight; the sparrow is not one of the most favored birds in this respect; the eagle, the falcon, the sea-mew, on the other hand, are wonderfully endowed in regard to flight. Who has not admired, on fine evenings, the dizzy, darting whirls of the great swallow? No doubt the relative dimensions of the wings, the general shape of the body, permit us to account in a certain degree for the greater or less ease of movement in birds; but this unequal distribution of the power of locomotion is not due merely to the proportions of the

body and limbs; it arises also from the extension of the respiratory apparatus, and from the force of circulation of the blood. If a pheasant were swept along with the rush of a falcon, or a sparrow with a swallow's swiftness, the unhappy pheasant and wretched swallow would be blown immediately, and would soon fall helpless. With birds, the size of their air-receptacles is always in perfect relations with the degree of activity, the energy of movement, and power of flight. In this respect, comparative study, which has not yet been made thoroughly enough, would furnish remarks of great interest. With an increased or diminished activity of respiration, the circulation of the blood, too, shows corresponding variations, within limits fixed by the structure or the arrangement of the organs. In the great fliers the heart is larger in proportion to the size of the body than in sedentary species. The left ventricle, which propels the vital fluid into the whole arterial system, has walls of considerable thickness, supported also by strong muscular columns, in birds of powerful flight, where its contractions need to be made most energetically. It is curious to follow in examination the whole series of slight variations in ducks, cranes, flamingos, gulls, and birds of prey, in which last the highest degree of perfection is realized. In species that have a feebly-sustained flight, as gallinaceous birds, parrots, or sparrows, the same walls and muscular pillars of the heart present in comparison only a weak resistance. In the same way the capacity of the right ventricle, into which the blood flows from the veins, is modified: of moderate size in those species of quiet habits, it is large in species more energetic in movement and capable of performing long journeys.

In old times simple persons had the notion that, by merely fastening wings to their shoulders, they could succeed in rising into the air. If the idea was really carried so far as the beginning of execution, the attempt must have at once satisfied the most enterprising of the emptiness of the project. Man has not the strength to manage great wings; and, if he had the strength, the proportion and weight of his body would remain invincible obstacles. The bird, completely covered with feathers, admirably shaped for its usual mode of moving, has muscles of enormous strength to supply motion to its fore-limbs; and it presents but little weight, for its body contains great pockets always full of air, and its bones, for the most part, are hollow. In our days, the idea of navigating the air comes up again constantly; there are inventors who usually give themselves very little concern about the views of science, and who, nevertheless, are well satisfied of the possibility of success. Does not the model seem to exist in Nature? But it is that model precisely that inspires the naturalist with the fear that the pursuit is chimerical. The size of an eagle or a condor is not very considerable, and the bird which attains still greater dimensions, yet without losing any of the essential characteristics of the type to which it belongs, is incapable of flight. The ostrich and the cassowary stay on the ground; the gigantic dinornis, which still inhabited New Zealand a few years ago, did not fly; the *épyornis* of Madagascar, whose enormous eggs have been the theme of astonishment, and almost of admiration, was not more favored than the other birds mentioned. Thus the observation of what exists in Nature leads us to think that locomotion through air is incompatible with great size.

We do not intend to select instances from all the classes of the animal kingdom of coincidences between specialties of organization and aptitudes; but there is one which invites citation, because it relates to animals habitually in every one's sight. A carp lives comfortably in a narrow reservoir with muddy water seldom renewed; a trout thrown into the same water dies asphyxiated in a few minutes; for a trout requires running water always well aërated. The carp consumes little oxygen; its respiration is weak. A trout's respiration is far more active. The difference in function is explained by certain arrangements in the branchiæ and the apparatus of circulation, and then we understand the necessity for the trout of an entirely different abode from that of the carp.

Among the remarkable peculiarities of the life of beings, there are few more instructive than the exceptions presented in a large number of natural groups. Thus, if the representatives of one class are usually land-animals, some, nevertheless, dwell in the water; if a class is composed of species essentially aquatic, several species of that zoölogical division have the power of escaping from their element; such a difference in the conditions of existence does not ordinarily require a profound modification of the organism. We are here struck by the simplicity of the means used by Nature to obtain an important result. Among fishes and crustacea, animals so admirably formed for their usual mode of life, there are species which, voluntarily or by accident, pass a part of their existence out of water. In aquatic animals death occurs as soon as the organs of respiration, ceasing to be moistened, begin to dry up.

If an arrangement exists fitted to prevent the flowing away of the liquid contained in the compartment which holds the branchiæ, the animal will be able to live a pretty long time in the open air. Eels, which are fond of rambling about, and venture into the middle of meadows without danger, owe that power to the mode of closing up their respiratory cavity. The anabas of Indian rivers, the gourami of China, are very much better furnished; they have a true reservoir formed of cells surrounded by leaf-like plates; thus, without the least inconvenience, they can leave their usual abode, and even make tolerably long journeys; the water from their reservoir flowing out slowly moistens the branchiæ.

Like fishes, crustacea in general live constantly in the water. Some crabs, it is true, quit the sea, but cautiously; they do not go far from the shore, and their excursions are not long. Some species only penetrate into the land, and go to a distance, ranging over the country for a month at a time. These land-crabs, as they are called, almost all prettily adorned with lively colors, are spread through the warm regions of South America, and abound in the Antilles, where they mark their passage through the fields with devastation. They are distinguished from other crabs by a rounded and very high shell. The advantage of this arrangement is at once apparent: the shell being very high, the respiratory chamber becomes spacious; and this chamber, well closed, lined with a permeable membrane, being full of water, the branchiæ are constantly moist. The air breathed is thus kept in a state quite sufficient for the needs of respiration. For a crustaceous creature which can climb trees, quite abundant on the Indian coasts, the Molucca and Seychelles Islands, etc., the means of living a long time out of water are provided by another arrangement, also very simple. This creature, of large size, called the robber-crab because it eats fruits, has neither a very convex upper shell nor a very large respiratory chamber; but above its branchiæ is a vascular sort of vegetation, fit to retain moisture, and acting in the manner of a sponge. Everywhere we succeed in establishing a close relation between the organization and the aptitudes, between the instincts and the characteristics of external parts. It is thus that the conditions of life imposed on each species seem to us determined in a way that forces us to regard as impossible any modifications that are at all considerable in animated beings.

There is one relation of a peculiar kind, most interesting to follow in its different manifestations—that which exists between the faculties of adult animals and the condition of new-born ones. The lower orders are of a constitution strong enough from the time of their birth to supply their own needs without aid from others. Those species that offer us the spectacle of most admirable instincts are born weak, and incapable of life without the care of mothers or nurses. Among the beings that suckle their young, do we not see the most intelligent, the most gifted in all respects, come into the world in a state of extreme weakness, which imposes on parents and especially on mothers the duty of watching over and protecting their children for a long period? Man is the first and most striking instance of this. Among birds there is a more marked difference than among mammals, which all, without exception, draw the first nourishment from their mothers. Chicks, when they leave their shell, are even then strong and able to get their own food; they do indeed follow their mother, and seem to seek her protection; but, if they stay close by her and take refuge under her body, it is solely for the sake of the warmth indispensable to all young creatures. William Edwards, the famous physiologist, showed nearly half a century ago that in newly-born animals the power of producing heat is seldom so much developed that the temperature of the organism can be kept up to the normal degree, if the atmosphere grows very cold. The observations and experiments of naturalists proved that young animals ought to be kept very warm, and that in this respect the maternal instinct never errs. Villermé and Milne-Edwards ascertained, by a grouping of well-established facts, that the human species is not excepted from the general law, and they were thus led to protest against the barbarous regulation which obliges new-born children to be carried to the mayors' offices for registry, thus in fact exposing them to the risk of death, if the cold affects them. They demonstrated the danger with the support of undeniable scientific facts, and yet a few choice spirits needed unconquerable perseverance for forty years before they could overcome administrative routine, and gain the abolition of a custom like that at Paris.

If the young of the hen and the duck, birds of very limited intelligence, have no other need of the mother on quitting the shell than to warm themselves by her, on the contrary, all those charming birds that delight us by their songs, their industry, their loves, their intelligence, the more wonderful in our eyes the more daintily small the creature is, all those that we train to

live in our domestic life, those that utter human speech, and those proud birds, too, the eagle and the falcon, are compelled to watch long over their young. The latter are condemned to dwell in the nest for weeks or months, and receive everything from their parents. And what parents they are—those bold sparrows, those warblers and nightingales with their liquid trills, those parrots with noisy chatter, those shrill-voiced falcons! Skillful in building their downy nests, full of contrivance in gathering their materials, they suffer the most painful fatigue in watching over their progeny; to defend them against possible attacks, they display wonderful activity in seeking the food suitable for their young, and devote untiring love to them. The necessity of rearing their brood and laboring for them brings about the lasting union of two individuals, a male and a female, happy in being united in a feeling of mutual affection, and the family is formed. The law is general. The need and the satisfaction of a joint life do not extend beyond one season, if in that space of time the young have grown strong enough to take their freedom, but they continue longer if the growth of the brood is slower. If they require the aid of their parents for a very considerable time, the pair will continue mutually attached almost for an indefinite period. Jules Verreaux, the naturalist-traveler, who had grown particularly well acquainted with the history of birds, has noticed an instance of this in a species which is of great interest for many reasons. Every one has remarked in menageries that singular bird of prey which is called indifferently the messenger, the secretary, or the serpent bird. Its legs are comparable in length to those of a crane or stork; it is a sort of falcon mounted on stilts. It has a grave and proud walk; a stiff tuft placed behind the head and always quivering gives it a look of great elegance. On account of this tuft the bird was named the secretary by those who saw a resemblance in it to the pen carried behind the ear by people whose business is copying, and called the serpent-bird by those who preferred to designate a peculiarity in the habits of this dweller in Southern Africa.

These secretaries, very abundant in the neighborhood of Cape Town, are protected by the inhabitants on account of the services they render in the colony. Near to most of the dwellings there is a pair of them which fixes its eyrie on the top of tall bushes, and very usually in the upper part of the mimosa. As these birds are constantly hunting serpents, we easily understand the usefulness of their high stilts. They overlook the region about, and, their sight being very keen, they distinguish the reptile at a distance, and some precaution in the attack is necessary. The secretary, therefore, on discovering his prey, advances prudently, and, with sparkling eye and ruffled neck and throat feathers, watches the opportune moment, then springs forward with a bound, and often kills its victim by a single blow of the claw given with incredible force. Sometimes the wounded serpent rears furiously, hissing with rage, and springs at its enemy; but the bird, soon recovering from its hesitation, and naturally courageous, opens its wings to serve as a shield, avoids the attacks by quick springs, and when the reptile drops to the ground tired and exhausted, it comes nearer and kills it with strokes from its claws. A battle of this kind between a secretary and a dangerous serpent always leaves a strong impression on the minds of those who see it. There are circumstances in the life of this bird of the Cape interesting in a much higher way. Its early age continues remarkably long; the young secretaries remain in the nest at least six months; they have gained within a very little the size of the old birds, but are still incapable of going in search of their food. Their legs and their tarsi, of extraordinary size, gain solidity very slowly, and, until consolidation is complete, they could not undertake the dangerous hunts to which their instinct and their appetite urge them. To feed this great and surprisingly voracious brood imposes on the parents the duty of making incessant war upon snakes, and, when they grow rare in the fields, of picking up lizards and even insects. The need of providing for the wants of their young during half the year, following the long time taken in building the nest and then in hatching, thus brings about a nearly indissoluble union between the male and female of the secretary-bird.

This difference between birds appears also in quite as marked a way between insects—some full of intelligence and so weak in the early time of life that their existence would be impossible without the family; others, little gifted with instinct and with intelligence, coming into life in so advanced a state of development as to be quite able to take care of themselves. In general, insects at their birth have no need of any assistance; but the species of some groups quit the egg in such a state of weakness that they would instantly perish if they did not receive the care of a mother or a nurse. These are those wonderful insects, wasps, humblebees, honey-bees,

and ants, whose industry, instincts, and intelligence confound our reason.

We have remarked the rule: those beings gifted with the finest organization have progeny too weak to be safely left to themselves; therefore the parent cares for them. But the rule has its exceptions. Some species, quite like those that are most remarkable for their industry, do not know how to do anything for their young, and yet their offspring at the beginning of life require assistance every moment. An imperious want to be satisfied on one side, absolute impotence to help on the other—this is the problem of which the solution is found by the aid of a special instinct bestowed on mothers unable to work for their progeny. When one cannot rear one's children, they are confided to strangers—nothing is simpler. The bird called the cuckoo is well known, and very curious stories are still told about it, sometimes without distinguishing between old legends and the accounts of careful observers. The cuckoo, which is constantly heard in large woods and hardly ever seen, from its extreme shyness, builds no nest, as every one knows. Unable to construct one, it goes and drops its eggs in the nest of some other bird. The reason of that incapacity eludes us, for till now no known peculiarity of its organism has furnished an explanation. Yet a very curious observation has been made: the members of the two sexes are very unequal; there are fifteen or twenty males for a single female. In this crowd of suitors the female, it would seem, wishes to please all, and her incessant gallantries must divert her from any maternal duty. The cuckoos, then, secretly carry their eggs to the nests of different birds—the red-throat, the nightingale, the redwing, the peewit, and many others besides—and these birds, if they do not detect the cheat, hatch the alien egg, and, after it is hatched, rear the intruder as one of their own brood, notwithstanding its size, which soon grows beyond that of the rightful young, and becomes very dangerous to them. If we are to believe some assertions, the female cuckoo never wholly loses the feeling of maternity: she does not leave the neighborhood of the places where her young are reared till after they have quitted the nest.

Some insects behave nearly like the cuckoo. The great downy humblebees, sometimes red, sometimes black, with some parts yellow, tawny, or reddish, so common in the fine season about the flowers in the fields or the edge of the woods, are wonderfully industrious creatures, as we know, and take the most irreproachable care of their progeny. Besides these laborious insects, we find species incapable of any care, and so like the true humblebee in their appearance and principal marks that painstaking naturalists had not been able to distinguish the two kinds; but one day an observer, Le Peletier de Saint-Fargeau, more attentive than his predecessors, remarked a significant difference: these species, hitherto confounded with humblebees, are quite wanting in working-instruments; their legs have no sack to store the pollen, no prickles to attach the flakes of wax; the first joint of their tarsi, though quite broad, yet is not such a plate as the humblebees use, like a trowel, and carries no hairy tuft suited to brush off the collected pollen. No working-tools means evident inability to build, and also impossibility of feeding the larvæ. These insects, designated by the name of *psithyres*, have recourse to the humblebees for the preservation of their own species. There is a simple explanation of the resemblance given by Nature to these two kinds of creatures. The cuckoo, smuggling an egg into a small bird's nest, has no reason to fear being at a disadvantage if caught in the act by the owner. It is not the same with the insect that makes its way into the humblebee's nest. The habitation is always more or less filled and guarded by individuals whose sting is mortal. The best-managed trick would fail. Here the insect must deceive as to its kind, and seem a humblebee when it is not one. The psithyres, therefore, have received the gift of the size, shape, colors, and complete appearance of the humblebee, and as there are of the latter quite a large number of species known apart by their colors, so there are psithyres answering to the characteristic peculiarities of these different species. Seeing one of them, we may say, without fear of mistake, this is the parasite of that particular humblebee. The psithyre then enters, without being disturbed, the dwelling where they are working and bringing up the young insects; its dress makes it pass for a member of the family; it goes in confident that it will not be recognized as a stranger nor maltreated. In the cells built in view of a different purpose it deposits its eggs; the grubs that will come from them will have all the appearance of those of the humblebees, and the latter will make no difference in their nursing. Thus a relation is perpetuated between two species not belonging to the same genus. The humblebees could very well dispense with the psithyres, but the latter would inevitably perish by the disappearance of the former.

All those industrious insects that are commonly called solitary bees and mason-bees are equally exposed to receiving the visits of hymenoptera of the same family that have no power to work; but these strangers do not wear the livery of the species whose nests they invade; nor do they need it, as they proceed only by skill and craft. The solitary bee builds, by itself, the cradle of its offspring, and stores in each cell a supply of food just sufficient for the grub that is to be its tenant. In search of its provision it is obliged to be often absent; the bee that does not work, and has no other care than to contrive the deposit of an egg in the cell where its grub will eat the stock laid up for that of the laboring species, keeps in the neighborhood of the nest at which honey and pollen are arriving; it studies the position, takes advantage of the owner's absence to penetrate into the retreat, lays an egg in it, and then escapes by stealth, like the robber who is well aware of the risk he would run should he chance to be met.

When we direct our attention to the circumstances of the life of animated creatures, we are greatly struck by seeing on the one hand fortunately-endowed beings, whose conditions of existence seem full of charm, and on the other hand beings less favored, and even some that are in a manner disinherited, and that find life possible only by the assistance of species which have the gift of strength or of skill. Hence result certain really extraordinary associations of animals; sometimes the luckless one expects his subsistence from the good-will of the better endowed; oftener the weak accompanies the strong either to be carried about with it, or to profit by the leavings that the latter drops. M. van Beneden, the distinguished professor of the University of Louvain, calls these creatures that are thus attached to the fortunes of others *commensals*.

In some ant-hills little bright coleoptera live that are called *clavigeri;* their heads are crowned with thick antennæ, and on the sides of their bodies grow tufts of hairs. These creatures are indeed disinherited; completely blind, with mouths having their articulated parts very small, and scarcely movable, they cannot eat of themselves, and the aid of the ants is indispensable to them. Between these insects there exists a connection of the most extraordinary sort, which has been very closely observed by an able naturalist, M. Lespès. The clavigeri shed a sweet fluid, which clings to their hairy tufts; the ants, greedy for anything that is sugary, swallow this fluid, and the clavigeri become favorite guests for them. In return for their good offices, they feed them by mouthfuls. When an ant-hill is disturbed, every one knows with what zeal, activity, and anxiety the ants carry off their grubs and nymphæ to put them out of the reach of danger. They act in the same way with regard to the clavigeri when they suppose them to be threatened. In spite of all this, a dependent condition is the fate of the latter in the community, in which each one finds its part; it is slavery made inevitable by defects in organization. For the philosopher, there is, perhaps, one thing even more interesting than this state of slavery in the relations between ants and clavigeri. The repeated experiments of Lespès prove that ants need some training to appreciate the benefits they may gain from these little bright coleoptera. All ant-hills of the same species do not own clavigeri. If one takes a fancy to put a few of these poor blind things into a nest where there are none of them, the ants have no suspicion of the happiness intended to be provided for them. With their instinct of seeking to account for everything that takes place in their dwelling, they examine the intruders, and, failing to discover the possibility of getting any good out of them, they pull them to pieces.

In some companionships of individuals of different species, a sort of equality rules: that of the mussel and the little crab known by the name of the *pinnothera* gives an instance of this. The pinnothera, which has been very unjustly charged with possessing properties injurious to the animal economy, finds a shelter in the mussel. Covered by a shell of stony hardness, armed with powerful claws, and gifted with excellent sight, it falls suddenly on its prey, and quietly devours it, the mussel receiving the remnants. It gives food, and receives lodging in return. Most frequently the association is of advantage only to the weaker individual, which, moreover, is the only one of the two that seeks it. Some quite small fish take up their abode in the mouth of a large species of silurus on the Brazilian coast, which is skillful in fishing with the help of its beard-like appendages, and there seize what they require as it goes by. A slender-shaped fish of the Mediterranean, the *fierasfer*, rather ill adapted for pursuing its prey, makes its way into the stomach of the *holothuria*, where it feeds at its ease. The holothuria are zoöphytes covered by a very leathery integument, and having the mouth encircled by branchy tentacles. The Chinese eat them, particularly the kind that is known as the edible trepang. Many animals with very imperfect means of locomotion, especially some crus-

tacea, fasten themselves upon fish and cruise about in search of subsistence. Some species, of lower organization, lose their liberty entirely; the cirrhipeds fix themselves, and are never again detached, drawing floating particles toward their mouths by the help of appendages converted into fringed tendrils. The coronulæ, which belong to this group, fix themselves on the skin of the whale, and are thus carried about in the water, where they find the microscopic creatures fit for their food in profusion.

Another kind of companionship is that of parasites with creatures from which they draw their subsistence directly. Some of these parasites are of so low an organization, that their introduction to the individuals destined to give them shelter seems to depend on chance. Intestinal worms have no appendages, and move within the narrowest limits; the presence of these worms in the place where existence is possible for them is the work neither of their instinct nor of that of their parents. Beings have the power of struggling against the chances of accident in proportion as their organization is perfect, and as their instinct and intelligence are developed. In the case of inferior species, much exposed to risk of destruction, this disadvantage is compensated by very great fecundity. In species that have no power of self-defense, fecundity becomes enormous. Intestinal worms are placed in a situation to live, only through circumstances almost casual; their eggs are produced and scattered in incalculable numbers.

All coincidences of the nature of those we have inquired into between the organism of beings and their physical aptitudes may be followed in their least details by observation and experiment. But science should not pause at phenomena of the physical order in its study of life; those of the psychological order fall within its ken also. The bond between these two orders of phenomena is a close one. To be convinced of this, it is enough to compare some animals with each other, in all their manifestations, and again to compare these animals with man himself. We are long past the time when animals were seriously believed to be mere machines.

The mind of man was very early impressed by the prodigious differences presented in the forms, the organic structure, and the habits of beings. The diversity is indeed immense, for each species bears its stamp in perfectly appreciable zoölogical and biological characteristics; but, after a long series of researches, unity in a general plan has become manifest. We have discovered in all animated beings the same organic apparatus, the same tissues, the same functions, the same beginning. The difference consists in the degree of development or of perfection, and in the adaptations. Are the powers that lie within the realm of intelligence governed by another law? The mere statement of the question suggests all the contradictions to the harmony of natural phenomena that such a supposition would require; and a comparison of the facts best demonstrated by observation and experiment yields manifest proofs that the law is the same. Cuvier once said, "To know man thoroughly, he must not be studied only in man." The great naturalist was thinking particularly of the material details of the organism. With equal truth it may be added, "To understand intelligence thoroughly, it must not be studied only in the manifestations of human intelligence."

As the details already related concerning the life of different animals have enabled us to judge, those instincts which are greatly developed in species endowed with a fine organization become restricted as the organization is lowered. Every animal has an instinct to employ the instruments it possesses, and the nature of its instruments determines the kind of its operations. Man forms no exception to this rule. Could we imagine men gathered in a small isolated group who would fail to make use of their hands to fashion weapons, tools, utensils, to build a shelter with materials within their reach, to prepare clothing, if cold renders it necessary? A resemblance in the products of industry of tribes very far separated has sometimes led to the supposition of ancient connections, or a common origin, when the truth would have been found in the recognition of the fact that these individuals had obeyed the same instincts, without needing any tradition. Intelligence everywhere shows itself joined with instinct; there is no instinct possible without an intelligence to guide and rule it. Some have believed in two sorts of mutually independent phenomena, for want of having studied the circumstances of life in man, in the mammals, birds, and insects, in a comparative manner. Intelligence has its degrees, evident as regards individuals, far more evident as regards species, and precisely as in the organism its inferiority or its perfection does not always relate to the whole, but only to certain portions, so intelligence may remain high in certain points, and very weak in other points. It would be a singular mistake to see in the intelligence of animals only a proportionate reduction of our own intelligence. Buffon

was misled by a notion of that sort, when he refused to recognize anything more than mechanical instinct in the beaver, because that animal has not the sense of the dog or the fox. The beaver possesses tools fit for cutting wood in its powerful incisor-teeth, a true trowel in its tail, and hands almost in its fore-paws. It has everything needed for building, and the instinct of construction, too, and its intelligence is admirably displayed in the series of acts required by its labors. Beavers choose the most suitable place for their establishment: on a river subject to floods they raise a dam before building their habitation; they dispense with that labor on a lake where the level varies but little; they fell a tree so as to make it drop toward the waters, that is, on the proper side; they cut it up as they need; individuals divide the task, one driving the stakes, another plastering the mortar; they guard against accidents and inundations. What a series of observations and reflections is necessary here! The beaver has a specialty, and in that specialty he possesses wonderful intelligence; apart from that, he is commonplace enough, and certainly, as Buffon remarks, has not the sense of the dog.

It is impossible to think without a kind of terror of what would become of the intelligence of a man deprived of all his senses. All our ideas of the outer world come to us by their intervention. The same senses, in very varying degrees of development, exist in animals; but researches of vast range are indispensable before we can estimate with complete exactness the shades in the impressions which the organs may transmit; such researches will be made, and the result cannot fail to enlighten us as to phenomena of the intellectual order. The possibility of attaining an explanation of all the perceptions of beings by a comparative study of the organs of the senses seems manifest. We cannot as clearly discern how much light the anatomical investigation of the brain will throw upon the actions of the mind; at present these actions are only recognizable by the manifestations that strike us. We merely note in a general way that the relative volume of the brain and the degree of centralization of the nervous masses have a relation to the extent of the instincts and intelligence. But, as soon as we shall have gained a precise idea of the organs of sense and the faculties in each species, being then able to determine the range of perceptions in each animal in the most exact way, we may be allowed to entertain the hope of reaching an important result by studying the brain in a comparative manner in those species that are known to be susceptible of the same perceptions, and in those species that have perceptions of a different kind. By proceeding in this way, science, which rejects any belief derived from imagination, will not desert the paths of observation and experiment.

Well-organized beings have an astonishing memory, constantly observed by persons who love the company of animals: they remember a benefit, and particularly an injury. A dog recognizes the friend of the house after many years, and the places he sees again after long absence. The faculty of reasoning, comparing, understanding situations, is inseparable from memory. Wild animals show themselves trustful in localities where man lets them live in peace, and full of distrust in places where his presence has become formidable to them. The testimony of travelers who have explored uninhabited countries is valuable to refer to. "It is a singular thing," says Livingstone, "to notice the intelligence of wild animals. In countries where they are hunted with firearms, they keep themselves in the most open parts of the region, so as to see the hunter at the greatest possible distance. It has so often happened to me when I had no weapons to get near to animals without disturbing them, which took flight as soon as I came in sight armed with a gun, that I am satisfied they perfectly understand the danger they run in the latter case, and the security they may feel in presence of an unarmed man. Here, where they have only the arrows of the Balondas to fear, they remain during the day in the depths of the thickest forests, where the use of the bow is much more difficult."

It is curious to watch the efforts of an animal endeavoring to get an understanding of something. A glass is put on the ground, and a cat, coming up to it, shows great surprise and curiosity at the sight of her reflection. She approaches, supposing it to be another animal of her own species, and, not being able to touch it with her nose, strikes at the glass with her claws. Meeting an obstacle, she goes to look behind the frame, and finding no one there, comes back and begins the same actions over again, still in vain; then, as if seized by a bright idea, her body quivering, her hair erect, she stands upright against the frame, striking it on both sides at once with her paws, as if to be sure not to fail in catching the puzzling presence. But after satisfying herself of the uselessness of her manœuvres, she leaves the place, resigned to do without understanding, very much like an Arab to whom one had attempted to explain the system

of electric telegraphing. Notwithstanding this, the animal has given proof of something besides a mechanical instinct. It has been doubted whether animals were conscious of their acts, and yet, though attentive examinations have not been made, the commonest observation should remove any uncertainty in this respect. A dog has been trained not to touch provisions in the house he lives in, but sometimes he cannot resist the temptation; if he takes some dainty bit it is always by stealth, and, if he is afraid of being caught, he makes off with all speed like a true robber. A cobaya, or Guinea-pig, an animal of rather limited intelligence, was living as a pet in a house. The poor little creature was passionately fond of fruit, and at its master's dessert, while he was alone absorbed in reading, it would be put on the table covered with strawberries, apples, or pears, knowing that it was forbidden to take anything unless given to it. On some days, if it was not helped at once, the temptation grew too strong; the least sign would check it, but tired of waiting it would come and rub its nose against its master's arm, and crawl after him whining, if its appeals seemed not to be heard. Facts as conclusive might be recounted almost without end. The sentiments and passions show themselves in animals under almost all aspects. A dog conceives affection for one person, hatred for another, having all kinds of preferences and dislikes. A parrot receives the kindest treatment from all the members of the family that keeps it as a pet; for one of them it has nothing but friendship, good-nature, and amusing ways; with another it is indifferent, and to a third is ill-tempered. An intelligent animal is full of tenderness in its love-making. The pleasing little song-birds are a charming study in their courtship; the emotion they feel is betrayed by signs of every kind, their breasts heave with unusual force, their little hearts beat quicker. Sentiment is the privilege of all the nobler creatures.

It would be a great error to suppose that animals are not sensible of beauty. At some times they even seem inspired by the desire to appear beautiful; stags and all the species of the feline race take a proud attitude; birds that have a handsome tuft, erect it, and those with showy tails, such as peacocks, display them, as if possessed with a feeling of pride. Besides, it is evident, from observation, that beauty in the individuals of one sex must produce quite a strong impression on those of the other sex. They gain their greatest brilliancy at the time of pairing of the sexes. Fishes, in which only a few faint gleams of intelligence are remarked, assume colors of surprising brilliancy at that season. Many birds in their bridal plumage seem to have put on wedding-garments; the graceful goldfinch, the gay chaffinch, are brilliant with color; the bullfinch, usually a dull rose, gleams in purple. It would be a mistake to suppose that among finely-organized animals a male with power to choose should pair indifferently with any chance female, or a female choose her mate without the least regard to external beauty; observation forbids such an opinion to be accepted. A distinguished amateur, Count Primoli, who loves birds and knows very many interesting things about their housekeeping, had obtained several of those huge pigeons produced by a series of selections, and known by bird-fanciers under the names of Dutch pigeons and Roman pigeons. The pairing-season came, and it was their time for choosing a husband or a mate for each. There were some common pigeons in the neighborhood; and it happened that every large pigeon went in search of a small mate, while every large female took a male of small size. It is not among animals only that such things are seen. To keep up the breed, it was necessary to make communication with others impossible.

The mammals and the most highly-endowed birds display pleasure at the thought of amusement, as hunting-dogs when they see the gun taken down, or spirited horses when getting harnessed. They are susceptible of *ennui*, and we know that *ennui* is sometimes fatal, even to beasts. The conditions of life are limited to merely material wants only among the lower species. Mammals and birds delight in amusing themselves; often a kitten will not play alone and invites you by its manner to play with it. Animals have fearful fits of rage, and the passion of revenge can excite them in a high degree; it extends even to insects, such as wasps and bees, which pursue an assailant and strive to sting him for whole hours. All creatures show laziness; the bird whose task it is to build a nest gets rid of the work if it finds an old nest which it can put in order easily. Some persons have had the idea of taking advantage of this laziness to retain small birds in places where they had become rare, or even to tempt them back; artificial nests were put into trees and bushes, and with complete success. Most of the solitary bees have their laziness too. Some species of this group, which are called *anthidies*, gave an English naturalist an example of laziness that deserves to be noted, such intelligence does it prove in these

strange insects. The anthidies usually furnish their nests with a sort of flannel which they make slowly out of the flock gathered from the fruit of the figwort, or from mullein; some insects of this kind, finding some flannel clothes drying in a field, went to cut fragments from them. Their work was done at once.

Man, who is superior to the whole of creation in his general physical aptitudes, his intellectual powers, and the possession of speech, is subject in this world to the same laws as other creatures. It has often been complacently said that he alone makes progress, and a famous physiologist, who has given much attention to the functions of the brain, has expressed the thought in this sententious way: "The animal never makes progress as a species; man only, as a species, makes progress." This seems to be equivalent to saying that men of to-day have a natural superiority over those of the age of Moses or the times of Pericles; in reality, this is confounding the human race with society, which does grow perfect and elevated by the labor of its members.

In conclusion, that grand character of unity which results from the multitude of facts of the physical order, results alike from the multitude of facts in the intellectual order that are best observed and least open to discussion. Precisely as aptitudes and functions diminish in importance when their instruments become simple, and vanish when the organs cease to exist, so the faculties of the intellectual order decrease as the organism is lowered. Nowhere do the phenomena of life differ essentially; here displaying themselves with power, there in a feeble way, they disappear when the instruments for their production no longer exist. In animated beings the connection between all phenomena is extremely close, and by itself the recognition of this truth, which is a new advance won from study and reason, opens a new path for scientific investigation, and promises new illumination to the human mind.

DR. CARPENTER ON SPIRITUALISM.[1]

By ALFRED RUSSELL WALLACE.

THE two lectures which Dr. Carpenter gave last year at the London Institution were generally reported by the press and led to some controversy. They were then published in *Fraser's Magazine*, and they are now republished with what are considered to be *pièces justificatives* in an appendix. We may therefore fairly assume that the author has here said his best on the subject—that he has carefully considered his facts and his arguments—and that he can give, in his own opinion at least, good reasons for omitting to notice certain matters which seem essential to a fair and impartial review of the whole question.

Dr. Carpenter enjoys the great advantage, which he well knows how to profit by, of being on the popular side, and of having been long before the public as an expounder of popular and educational science. Everything he writes is widely read; and his reiterated assurances that nobody's opinion and nobody's evidence on this particular subject is of the least value unless they have had a certain *special early training* (of which, it is pretty generally understood, Dr. Carpenter is one of the few living representatives) have convinced many people that what he tells them must be true, and should, therefore, settle the whole matter. He has another advantage in the immense extent and complexity of the subject and the widely scattered and controversial nature of its literature. By ranging over this wide field and picking here and there a fact to support his views and a statement to damage his opponents, Dr. Carpenter has rendered it almost impossible to answer him on every point, without an amount of detail and research that would be repulsive to ordinary readers. It is necessary, therefore, to confine ourselves to the more important questions, where the facts are tolerably accessible and the matter can be brought to a definite issue; though, if space permitted, there is hardly a page of the book in which we should not find expressions calling for strong animadversion, as, for example, the unfounded and totally false general assertion at page 6, that "Believers in spiritualism make it a reproach against men of science that they entertain a prepossession in favor of the ascertained and universally admitted laws of Nature."

[1] "Mesmerism, Spiritualism, etc., historically and scientifically considered. Being Two Lectures delivered at the London Institution, with Preface and Appendix." By William B. Carpenter, C. B., M. D., F. R. S., etc., etc. New York: D. Appleton & Co. 1877.

Vague general assertions of this kind, without a particle of proof offered or which can be offered, are alone sufficient to destroy the judicial or scientific claims of the work; but we have no intention of wasting space in further comment upon them.

Dr. Carpenter lays especial stress on his character of historian and man of science in relation to this inquiry. He parades this assumption in his title-page and at the very commencement of his preface. He claims, therefore, to review the case as a judge, giving full weight to the evidence on both sides, and pronouncing an impartial and well-considered judgment. He may, indeed, believe that he has thus acted—for dominant ideas are very powerful—but any one, tolerably acquainted with the literature and history of these subjects for the last thirty years, will most assuredly look upon this book as the work of an advocate rather than of a judge. In place of the impartial summary of the historian he will find the one-sided narrative of a partisan; and, instead of the careful weighing of fact and experiment characteristic of the man of science, he will find loose and inaccurate statements, and negative results set up as conclusive against positive evidence. We will now proceed to demonstrate the truth of this grave accusation, and shall in every case refer to the authorities by means of which our statements can be tested.

The first example of Dr. Carpenter's "historical" mode of treating his subject which we shall adduce, is his account (pp. 13–15) of the rise of mesmerism in this country, owing to the successful performance of many surgical operations without pain during the mesmeric trance. Dr. Carpenter writes of this as not only an admitted fact, but (so far as any word in his pages shows) as a fact which was admitted from the first, and which never went through that ordeal of denial, misrepresentation, and abuse by medical men and physiologists, that other phenomena are still undergoing from a similar class of men. Yet Dr. Carpenter was in the thick of the fight and must know all about it. He must know that the greatest surgical and physiological authorities of that day—Sir Benjamin Brodie and Dr. Marshall Hall—opposed it with all the weight of their influence, accused the patients of imposture, or asserted that they might be "naturally insensible to pain," and spoke of the experiments of Dr. Elliotson and others as "trumpery," and as "polluting the temple of science." He must know, too, that Dr. Marshall Hall professed to demonstrate "physiologically" that the patients were impostors, because certain reflex actions of the limbs, which he declared ought to have occurred during the operations, did not occur. The medical periodicals of the day were full of this, and a good summary may be found in Dr. Elliotson's "Surgical Operations without Pain," etc., London, 1843. Dr. Carpenter tells us how his friends, Dr. Noble and Sir John Forbes, in 1845 accepted and wrote in favor of the reality of the facts; but it was hardly "historical" to tell us this as the whole truth when, for several years previously, the most violent controversy, abuse, and even persecution, had raged on this very matter. Great physiological authorities were egregiously in the wrong then, and the natural inference to those who know the facts is, that other physiological authorities, who now deny equally well-attested facts, may be no more infallible than their predecessors.

Dr. Carpenter persistently denies that there is any adequate evidence of the personal influence of the mesmerizer on the patient independent of the patient's knowledge and expectation, and he believes himself to be very strong in the cases he adduces, in which this power has been tested and failed. But he quite ignores the fact that all who have ever investigated the higher phases of mesmerism—such as influence at a distance, community of sensation, transference of the senses, or true clairvoyance—agree in maintaining that these phenomena are very uncertain, depending greatly on the state of body and mind of the patient, who is exceedingly susceptible to mental impressions, the presence of strangers, fatigue, or any unusual conditions. Failures continually occur, even when the mesmerizer and patient are alone or when only intimate friends are present; how, then, can the negative fact of a failure before strangers and antagonists prove anything? Dr. Carpenter also occupies his readers' attention with accounts of hearsay stories which have turned out exaggerated or incorrect, and lays great stress on the "disposition to overlook sources of fallacy" and to be "imposed on by cunning cheats," which this shows. This may be admitted; but it evidently has no bearing on well authenticated and carefully observed facts, perfectly known to every student of the subject. Our author maintains, however, that such facts do not exist, and that "the evidence for these higher marvels has invariably broken down when submitted to the searching tests of trained experts." Here the question arises, Who are "trained experts?" Dr. Carpenter would maintain that only skeptical medical men and professed conjurers deserve that epithet, however

ignorant they may be of all the conditions requisite for the study of these delicate and fluctuating phenomena of the nervous system. But we, on the contrary, would only give that name to inquirers who have experimented for months or years on this very subject, and are thoroughly acquainted with all its difficulties. When such men are also physiologists, it is hardly consistent with the historical and scientific method of inquiry to pass their evidence by in silence. I have already called Dr. Carpenter's attention to the case of the lady residing in Prof. Gregory's own house, who was mesmerized at several streets' distance by Mr. Lewis, without her knowledge or expectation. This is a piece of direct evidence of a very satisfactory kind, and outweighs a very large quantity of negative evidence; but no mention is made of it except the following utterly unjustifiable remark: "His (Mr. Lewis's) utter failure under the scrutiny of skeptical inquirers, obviously discredits all his previous statements, except to such as (like Mr. A. R. Wallace, who has recently expressed his full faith in Mr. Lewis's self-asserted powers) are ready to accept without question the slenderest evidence of the greatest marvels" ("Mesmerism, Spiritualism," etc., p. 24). Now, will it be believed that this statement, that I "place full faith in Mr. Lewis's *self-asserted powers*," has not even the shadow of a foundation? I know nothing of Mr. Lewis or of his powers, self-asserted or otherwise, but what I gain from Prof. Gregory's account of them; and in my letter to the *Daily News*, immediately after the delivery of Dr. Carpenter's lectures, I referred to this account. I certainly have "full faith" in Prof. Gregory's very careful narrative of a fact entirely within his own knowledge. This may be "the slenderest evidence" to Dr. Carpenter; but, slender or not, he chooses to evade it, and endeavors to make the public believe that I, and others, accept the unsupported assertions of an unknown man. It is impossible adequately to characterize such reckless accusations as this without using language which I should not wish to use. Let us pass on, therefore, to the evidence which Dr. Carpenter declares to be fitly described as "the slenderest." M. Dupotet, at the Hôtel de Dieu, in Paris, put a patient to sleep when behind a partition, in the presence of M. Husson and M. Recamier, the latter a complete skeptic. M. Recamier expressed a doubt that the circumstances might produce expectation in the patient, and himself proposed an experiment the next day, in which all the same conditions should be observed, except that M. Dupotet should not come till half an hour later. He anticipated that the "expectation" would be still stronger the second time than at first, and that the patient would be mesmerized. But the result was quite the reverse. Notwithstanding every minute detail was repeated as on the previous day when the operator was in the next room, the patient showed no signs whatever of sleep, either natural or somnambulic (Teste's "Animal Magnetism," Spillan's translation, p. 159). The commission appointed by the Académie Royale de Médecine in 1826 sat for five years, and investigated the whole subject of animal magnetism. It was wholly composed of medical men, and in their elaborate report, after giving numerous cases, the following is one of their conclusions:

"14. We are satisfied that it (magnetic sleep) has been excited under circumstances where those magnetized could not see and were entirely ignorant of the means employed to occasion it."

These were surely "trained experts;" yet they declare themselves satisfied of that, the evidence for which, Dr. Carpenter says, has always broken down when tested.

Baron Reichenbach's researches are next discussed, and are coolly dismissed with the remark that "it at once became apparent to experienced physicians that the whole phenomena were subjective, and that 'sensitives' like Von Reichenbach's can feel, see, or smell anything they were led to believe they *would* feel, see, or smell." His evidence for this is, that Mr. Braid could make his subjects do so, and that Dr. Carpenter had seen him do it. One of them, for instance—an intellectual and able Manchester gentleman—"could be brought to see flames issuing from the poles of a magnet of any form or color that Mr. Braid chose to name." All this belongs to the mere rudiments of mesmerism, and is known to every operator. Two things, however, are essential: the patient or sensitive must be, or have been, mesmerized, or electro-biologized as it is commonly called, and the *suggestion* must be actually made. Given these two conditions, and no doubt twenty persons may be made to declare that they see green flames issuing from the operator's mouth; but no single case has been adduced of persons in ordinary health, not subject to any operation of mesmerism, etc., being all caused to see this or any other thing in agreement, by being merely brought into a dark room and asked to describe accurately what they saw. Yet this is what Von Reichenbach did, and much more. For, in order to confirm the evidence of the

"sensitives" first experimented on, he invited a large number of his friends and other persons in Vienna to come to his dark room, and the result was that about *sixty persons*, of various ages and conditions, saw and described exactly the same phenomena. Among these were a number of literary, official, and scientific men and their families, persons of a status fully equal to that of Dr. Carpenter and the Fellows of the Royal Society—such as Dr. Nied, a physician; Prof. Endlicher, Director of the Imperial Botanic Garden; Chevalier Hubert von Rainer, barrister; Mr. Karl Schuh, physicist; Dr. Ragsky, Professor of Chemistry; Mr. Franz Kollar and Dr. Diesing, Curators in the Imperial Natural History Museum, and many others. There was also an artist, Mr. Gustav Anschütz, who could see the flames, and drew them in their various forms and combinations. Does Dr. Carpenter really ask his readers to believe that his explanation applies to these gentlemen?—that they all quietly submitted to be told *what* they were to see, submissively *said* they saw it, and allowed the fact to be published at the time, without a word of protest on their part from that day to this? But a little examination of the reports of their evidence shows that they did not follow each other like a flock of sheep, but that each had an individuality of perceptive power, some seeing one kind of flame better than another; while the variety of combinations of magnets submitted to them rendered anything like suggestion as to what they were to see quite impossible, unless it were a deliberate and willful imposture on the part of Baron von Reichenbach.

But again, Dr. Carpenter objects to the want of tests, and especially his pet test of using an electro-magnet, and not letting the patients know whether the electric circuit which "makes" and "unmakes" the magnet was complete or broken. How far this test, had it been applied, would have satisfied the objector, may be imagined from his entirely ignoring all the tests, many of them at least as good, which were actually applied. The following are a few of these: Test 1. Von Reichenbach arranged with a friend to stand in another room with a stone wall between him and the patient's bed, holding a powerful magnet, the armature of which was to be closed or opened at a given signal. The patient detected, on every occasion, whether the magnet was opened or closed. Test 2. M. Baumgartner, a professor of physics, after seeing the effects of magnets on patients, took from his pocket what he said was one of his most powerful magnets, to try its effects. The patient, to Von Reichenbach's astonishment, declared she found this magnet, on the contrary, very weak, and its action on her hardly more perceptible than a piece of iron. M. Baumgartner then explained that this magnet, though originally very powerful, had been as completely as possible deprived of its magnetism, and that he had brought it as a test. Here were *suggestion* and *expectation* in full force, yet they did not in the least affect the patient. (For these two tests, *see* "Ashburner's Translation of Reichenbach," pp. 39, 40.) Test 3. A large crystal (placed in a new position before each patient was brought into the dark room) was always at once detected by means of its light, yellower and redder than that from magnets (*loc. cit.*, p. 86). Test 4. A patient confined in a darkened passage held a wire which communicated with a room in which experiments were made on plates connected with this wire. As these plates were exposed to sunlight or shade, the patient described corresponding changes in the luminous appearances of the end of the wire (*loc. cit.*, p. 147). Test 5. The light from magnets, etc., was thrown on a screen by a lens, so that the image could be instantly and noiselessly changed in size and position at pleasure. Twelve patients, eight of them healthy and new to the inquiry, saw the image, and described its alterations of size and position as the lens or screen was shifted in the dark (*loc. cit.*, p. 585). Dr. Carpenter's only reply to all this is, that "Baron Reichenbach's researches upon 'Odyle' were discredited a quarter of a century ago, alike by the united voice of scientific opinion in his own country, and by that of the medical profession here." Even if this were the fact, it would have nothing to do with the matter, which is one of experiment and evidence, not of the belief or disbelief of certain prejudiced persons, since to *discredit* is not to *disprove*. The painless operations in mesmeric sleep were "discredited" by the highest medical authorities in this country, and yet they were true. But Dr. Elliotson, Dr. Ashburner, and others, accepted Reichenbach's discoveries; and some of the Vienna physicians even, after seeing the experiments with persons "whose honor, truthfulness, and impartiality they could vouch for," also accepted them as proved.

The fact of the luminosity of magnets was also independently established by Dr. Charpignon, who, in his "Physiologie, Médecine, et Métaphysique du Magnétisme," published in 1845—the very same year in which the account of Von Reichenbach's observations first appeared—says:

"Having placed before the somnambulists four small bars of iron, one of which was magnetized by the loadstone, they could always distinguish this one from the others, from its two ends being enveloped in a brilliant vapor. The light was more brilliant at one end (the north pole) than at the other. I could never deceive them; they always recognized the nature of the poles, although when in their normal state they were in complete ignorance of the subject." Surely here is a wonderful confirmation. One observer in France and another in Germany make the same observation about the same time, and quite independently; and even the detail of the north pole being the more brilliant agrees with the statement of Reichenbach's sensitives ("Ashburner's Trans.," p. 20).

Our readers can now judge how far the historic and scientific method has been followed in Dr. Carpenter's treatment of the researches of Von Reichenbach, not one of the essential facts here stated (and there are hundreds like them) being so much as alluded to, while "suggestion," "expectation," and "imposture," are offered as fully explaining everything. We cannot devote much time to the less important branches of the subject, but it is necessary to show that *in every case* Dr. Carpenter misstates facts, and sets negative above positive evidence. Thus, as to the magnenometer[1] and odometer of Mr. Rutter and Dr. Mayo, all the effects are imputed to expectation and unconscious muscular action, and we have this positive statement: "It was found that the constancy of the vibrations depended entirely upon the operator's watching their direction, and, further, that when such a change was made *without the operator's knowledge* in the conditions of the experiment, as *ought*, theoretically, to alter the direction of the oscillations, no such alteration took place." Yet Mr. Rutter clearly states: 1. That the instrument can be affected through the hand of a *third* person with exactly the same result (Rutter's "Human Electricity," App., p. 54). 2. That the instrument is affected by a crystal on a *detached stand* brought close to the instrument, but without contact (*loc. cit.*, p. 151). 3. That many persons, however "expectant" and anxious to succeed, have no power to move the instrument. 4. That substances *unknown to the operator*, and even when held by a third party, caused correct indications, and that an attempt to deceive by using a substance under a wrong name was detected by the movements of the instrument (*loc. cit.*, Appendix, p. lvi.). Here, then, Mr. Rutter's positive testimony is altogether ignored, while the negative results of another person are set forth as conclusive. Next we have the evidence for the divining-rod similarly treated. Dr. Mayo is quoted as supporting the view that the rod moved in accordance with the "expectations" of the operator, but on the preceding page of Dr. Mayo's work other cases are given in which there was no expectation; and the fact that Dr. Mayo was well aware of this source of error, and was a physiologist and physician of high rank, entitles his opinion as to the reality of the action in other cases to great weight. Again, we have the testimony of Dr. Hutton, who saw the Hon. Lady Milbanke use the divining-rod on Woolwich Common, and who declares that it turned where he knew there was water, and that in other places where he believed there was none it did not turn; that the lady's hands were closely watched, and that no motion of the fingers or hands could be detected, yet the rod turned so strongly and persistently that it became broken. No other person present could voluntarily or involuntarily cause the rod to turn in a similar way (Hutton's "Mathematical Recreations," ed. 1840, p. 711). The evidence on this subject is most voluminous, but we have adduced sufficient to show that Dr. Carpenter's supposed demonstration does not account for all the facts.

We now come to the very interesting and important subject of clairvoyance, which Dr. Carpenter introduces with a great deal of irrelevant matter calculated to prejudge the question. Thus, he tells his readers that "there are at the present time numbers of educated men and women who have so completely surrendered their 'common sense' to a dominant prepossession as to maintain that any such monstrous fiction (as of a person being carried through the air in an hour from Edinburgh to London) ought to be believed, even upon the evidence of a single witness, if that witness be one upon whose testimony we should rely in the ordinary affairs of life!" He offers no proof of this statement, and we venture to say he can offer none, and it is only another example of that complete misrepresentation of the opinions of his opponents with which this book abounds. At page 71, however, we enter upon the subject itself, and at once encounter one of those curious examples of ignorance (or suppression of evidence) for which Dr. Carpenter is so

[1] The magnenometer is a delicate pendulum, which, when its support is touched by certain persons, vibrates in a definite direction, the direction changing on the motion suddenly stopping when different substances are touched at the same time by the operator.

remarkable in his treatment of this subject. We have been already told (p. 11) of the French Scientific Commission which about a hundred years ago investigated the pretensions of Mesmer, and decided, as might have been anticipated, against him. Now we have the statement that "it was by the French Academy of Medicine, in which the mesmeric state had been previously discussed with reference to the performance of surgical operations, that this new and more extraordinary claim (*clairvoyance*) was first carefully sifted, in consequence of the offer made in 1837 by M. Burdin of a prize of 3,000 francs to any one who should be found capable of reading through opaque substances." The result was negative. No clairvoyant succeeded under the conditions imposed. The reader unaccustomed to Dr. Carpenter's historical method would naturally suppose this statement to be correct, and that *clairvoyance* was *first* carefully sifted in France *after* 1837, though he might well doubt if offering a prize for reading under rigid conditions was an adequate means of sifting a faculty so eminently variable, uncertain, and delicate, as clairvoyance is admitted to be. What, then, will be his astonishment to find that this same "Académie Royale de Médecine" had appointed a commisson of eleven members in 1826, who inquired into the whole subject of mesmerism for *five years*, and in 1831 reported in full, and *in favor* of the reality of almost all the alleged phenomena, *including clairvoyance*. Of the eleven members, nine attended the meetings and experiments, and all nine signed the report, which was therefore unanimous. This report, being full and elaborate, and the result of personal examination and experiment by medical men—the very "trained and skeptical experts" who are maintained by Dr. Carpenter to be the only adequate judges—is wholly ignored by him. In this report we find among the conclusions: "24. We have seen two somnambulists distinguish, with their eyes shut, objects placed before them: name cards, read books, writing, etc. This phenomenon took place even when the opening of the eyelids was accurately closed by means of the fingers."[1] Is it not strange that the "historian" of mesmerism, etc., should be totally ignorant of the existence of this report, which is referred to in almost every work on the subject? Yet he must be thus ignorant, or he could never say, as he does in the very same page quoted above (p. 71), "that, in every instance (so far as I am aware) in which a thorough investigation has been made into those 'higher phenomena' of mesmerism, the supposed proof has completely failed." It cannot be said that investigation by nine medical men, carried on for five years with every means of observation and experiment, and elaborately reported on, was not "thorough;" whence it follows that Dr. Carpenter must be ignorant of it, and our readers can draw their own inference as to the value of his opinion, and the dependence to be placed on his scientific and historical treatment of this subject.

More than twenty-five pages of the book are occupied with more or less detailed accounts of the failures and alleged exposures of clairvoyants, while not a single case is given of a clairvoyant having stood the test of rigid examination by a committee, or by medical or other experts, and the implication is that none such are to be found. But every inquirer knows that clairvoyance is a most delicate and uncertain phenomenon, never to be certainly calculated on, and this is repeatedly stated in the works of Lee, Gregory, Teste, Deleuze, and others. How, then, can any number of individual failures affect the question of the reality of the comparatively rare successes. As well deny that any rifleman ever hit the bull's-eye at one thousand yards, because none can be sure of hitting it always, and at a moment's notice. Several pages are devoted to the failure of Alexis and Adolphe Didier under test-conditions in England, ending with the sneering remark, "Nothing, so far as I am aware, has ever been since heard of this *par nobile fratrum*." Would it (to use an established formula) surprise Dr. Carpenter to hear that these gentlemen remained in England a considerable time after the date he alludes to, that they have ever since retained their power and reputation, and that both still successfully practise medical clairvoyance, the one in London and the other in Paris? To balance the few cases of failure by Alexis, Dr. Lee has given his personal observations of ten times as many successes, some of them of the most startling kind ("Animal Magnetism," pp. 255–277). We can only find room here for two independent and complete tests. The first is given by Sergeant Cox, as witnessed by himself. A party of experts was planned to test Alexis. A word was written by a friend in a distant town and enclosed in an envelope, *without any of the party knowing what the word was*. This envelope was inclosed successively in six others of thick brown paper, each sealed. This packet was handed to Alexis, who placed it on his forehead,

[1] "Archives Générales de Médecine," vol. xx.; also in Lee's "Animal Magnetism," pp. 13–29.

and in three minutes and a half wrote the contents correctly, imitating the very handwriting. ("What am I?" vol. ii., p. 167.) Now, unless this statement by Sergeant Cox is absolutely false, a thousand failures cannot outweigh it. But we have, if possible, better evidence than this; and Dr. Carpenter knows it, because I called his attention to it in the *Daily News*. Yet he makes no allusion to it. I refer to the testimony of Robert Houdin, the greatest of modern conjurers, whose exploits are quoted by Dr. Carpenter, when they serve his purpose (pp. 76, iii.). He was an absolute master of card-tricks, and knew all their possibilities. He was asked by the Marquis de Mirville to visit Alexis, which he did twice. He took his own new cards, dealt them himself, but Alexis named them as they lay on the table, and even named the trump before it was turned up. This was repeated several times, and Houdin declared that neither chance nor skill could produce such wonderful results. He then took a book from his pocket and asked Alexis to read something eight pages beyond where it was opened, at a specified level. Alexis pricked the place with a pin, and read four words, which were found at the place pricked nine pages on. He then told Houdin numerous details as to his son, in some of which Houdin tried to deceive him, but in vain; and when it was over Houdin declared it "stupefying," and the next day signed a declaration that the facts reported were correct, adding, "The more I reflect upon them, the more impossible do I find it to class them among the tricks which are the object of my art." The two letters of Robert Houdin were published at the time (May, 1847) in *Le Siècle*, and have since appeared in many works, among others in Dr. Lee's "Animal Magnetism" (pp. 163 and 231).

One of the supposed exposures made much of by Dr. Carpenter is that of Dr. Hewes's "Jack," which is suggestive as showing the complete ignorance of many experimenters thirty years ago as to the essential conditions of the manifestation of so delicate and abnormal a faculty as clairvoyance—ignorance shared in by believers and skeptics alike. According to Dr. Carpenter (whose account he informs me is taken from an article by Dr. Noble in the *British and Foreign Medical Review* of April, 1845), Jack's eyes were "bound down by surgeons with strips of adhesive plaster, over which were folds of leather, again kept in place by other plasters." Jack then read off, *without the least hesitation*, everything that was presented to him. But a young Manchester surgeon had his eyes done up in the same manner, and, by *working the muscles of his face* till he had *loosened the plasters*, was enabled to read by *looking upward*. The conclusion was immediately jumped at that this was the way Jack did it, although no *working of the muscles of the face* had been observed, and no *looking upward* described. Instead, however, of repeating the experiment under the same conditions, but more watchfully, it was proposed that the *entire eyes should be covered up with a thick coating of shoemakers' wax!* The boy objected and resisted, and it was put on by force; and then, the clairvoyant powers being annihilated, as might have been anticipated, there was great glorification among the skeptics; and Dr. Carpenter indulges himself in a joke, telling us that Jack now "plainly saw, even with his eyes shut, that his little game was up." To any one who considers this case, even as related by Dr. Carpenter, it will be evident that the boy was a genuine clairvoyant. Adhesive plaster, properly applied by a medical man on a passive subject, is not to be loosened by imperceptible working of the muscles; and it is too great a demand upon our credulity to ask us to believe that this occurred undetected by the acute medical skeptics watching the whole procedure. We have, however, fortunately, another case to refer to, in which this very test was carried out to its proper conclusion by examining the state of the plaster *after the clairvoyance*, when the alleged looseness could be instantly detected. A clairvoyant boy at Plymouth was submitted to the examination of a skeptical committee, who appear to have done their work very thoroughly. First his eyes were examined, and it was found that the balls were so turned up that, even were the eyelids a little apart, ordinary vision was impossible.[1] Then he was closely watched, and, while the eyelids were seen to be perfectly closed, he read easily. Then adhesive plaster was applied, carefully warmed, in three layers, and it was watched to see that the adhesion was perfect all round the edges. Again the boy read what was presented to him, sometimes easily, sometimes with difficulty. At the end of the experiments the plaster was taken off strip by strip by the committee, and it was found to be perfectly secure, and the eyelids so completely glued together that it was a work of some difficulty to get them open again. This case is recorded, with the names of the committee, in the "Zoist," vol. iv., pp. 84–88;

[1] This is a constant feature of the true mesmeric trance, but "Jack's" accusers seem to have known nothing about it.

and I call the reader's attention to the *completeness* of the test here, and its demonstration of the reality of clairvoyance, as compared with the loose experiment and hasty jumping-to-a-conclusion in the case which Dr. Carpenter thinks alone worthy of record.

Dr. Carpenter next comes to the work of Prof. Gregory ("Letters on Animal Magnetism"), and devotes several pages to assertions as to the professor's "credulity," the "reprehensible facility" with which he accepted Major Buckley's statements, the "entire absence of detail" as to "precautions against tricks," and his utter failure to find a clairvoyant to obtain Sir James Simpson's bank-note. "And yet," he says, referring especially to myself, "there are even now men of high scientific distinction who adduce Prof. Gregory's testimony on this subject as unimpeachable!" Readers who have accompanied me so far, will at least hesitate to accept Dr. Carpenter's dictum on this point, till they have heard what can be said on the other side. To give full details would occupy far too much space; I must, therefore, refer my readers to Prof. Gregory's book for some cases, and give merely a brief outline of others. At page 394 (Case 29) is given in detail a most remarkable test-case, in which Prof. Gregory sent some handwriting from Edinburgh to Dr. Haddock's clairvoyant at Bolton, who gave in return a minute description of the writer, her appearance, dress, house, illness, medical treatment, etc. At page 401 another test of the same kind is described. At page 403 a number of such cases are summarized, and one very completely given in detail. At page 423 is an account of a clairvoyant boy at the house of Dr. Schmitz, rector of the High School at Edinburgh. This boy described Prof. Gregory's house accurately, and the persons at that time in the dining-room (afterward ascertained to be correct). As a further test, Dr. Schmitz was asked to go into another room with his son and do anything he liked. The boy then described their motions, their jumping about, the son going out and coming in again, and the doctor beating his son with a roll of paper. When Dr. Schmitz returned, Prof. Gregory repeated all the boy had said, which the doctor, much astonished, declared to be correct in every particular. At page 445 (Case 42) is an account of another clairvoyant, a mechanic, who described Prof. Gregory's house in detail, and saw a lady sitting in a particular chair in the drawing-room reading a new book. On returning home the professor found that Mrs. Gregory had, at the time, been sitting in that particular chair, which she hardly ever was accustomed to use, and was reading a new book which had been sent to her just before, but of which the professor knew nothing. At page 405 is a most remarkable case of the recovery of a stolen watch, and detection of the thief in London by Dr. Haddock's clairvoyant at Bolton. The letters all passed through Sir Walter C. Trevelyan, who showed them to Prof. Gregory. At page 407 are the particulars of the extraordinary discovery of the locality of travelers by means of their handwriting only, sent from the Royal Geographical Society to Sir C. Trevelyan in Edinburgh, and by him to Bolton, he himself not knowing either the names of the travelers, or where they were. Many more cases might be referred to, but these are sufficient to show that there is not that "total absence of detail," and of "precautions," in Prof. Gregory's experiments, which is Dr. Carpenter's reason for entirely ignoring them. In addition to this we have the account of Dr. J. Haddock, a physician practising at Bolton, of the girl Emma, who for nearly two years was under his care, and residing in his house. Many of Prof. Gregory's experiments, and those of Sir Walter Trevelyan, were made through this girl, and a full account of her wonderful clairvoyant powers is given by Dr. Haddock in the appendix to his "Somnolysm and Psycheism." She could not read, and did not even know her letters. The discovery of the stolen cash-box and identification of the entirely unsuspected thief are given in full by Dr. Haddock, and are summarized in my "Miracles and Modern Science," page 64. Again, Dr. Herbert Mayo gives unexceptionable personal testimony to clairvoyance at pages 167, 172, and 178, of his book on "Popular Superstitions."

Dr. Carpenter is very severe on Prof. Gregory for his belief in Major Buckley's clairvoyants reading mottoes in nuts, etc., but Major Buckley was a man of fortune and good position, who exercised his remarkable powers as a magnetizer for the interest of it, and there is not the slightest grounds for suggesting his untrustworthiness. We have beside the confirmatory testimony of other persons, among them of Dr. Ashburner, who frequently took nuts purchased by himself, and had them correctly read by the clairvoyants before they were opened. ("Ashburner's Philosophy of Animal Magnetism," p. 304.) Dr. Carpenter also doubts Prof. Gregory's commonsense in believing that a sealed letter had been read unopened by a clairvoyant when it might have been opened and resealed; but he omits to

say that the envelopes were expressly arranged to prevent their being opened without detection, and that the professor adds, "I have in my possession one of the envelopes thus read, which has since been opened, and I am convinced that the precautions taken precluded any other than lucid vision." [1]

Still more important, perhaps, is the testimony of many eminent physicians to the existence of these remarkable powers. Dr. Rostan, Parisian Professor of Medicine, in his article "Magnétisme," in the "Dictionnaire de Médecine," says (as quoted by Dr. Lee): "There are few things better demonstrated than clairvoyance. I placed my watch at a distance of three or four inches from the occiput of the somnambulist, and asked her if she saw anything. 'Certainly,' she replied, 'it is a watch; ten minutes to eight.' M. Ferrus repeated the experiment with the same successful result. He turned the hands of his watch several times, and we presented it to her *without looking at it;* she was not once mistaken." The Commissioners of the Royal Académie de Médecine applied the excellent test of holding a finger on each eyelid, when the clairvoyant still read the title of a book, and distinguished cards. (Quoted in Dr. Lee's "Animal Magnetism," p. 22.) Dr. Esdaile had a patient at Calcutta who could hear and see through the stomach. This was tested by himself with a watch, as in the French case quoted above. ("Zoist," vol. viii., p. 220.) Dr. Teste's account of the clairvoyance of Madame Hortense is very suggestive. She sometimes read with ease when completely bandaged, and when a paper was held between her eyes and the object; at other times she could see nothing, and the smallest fatigue or excitement caused this difference. This excessive delicacy of the conditions for successful clairvoyance renders all public exhibitions unsatisfactory; and Prof. Gregory "protests against the notion that it is to be judged by the rough experiments of the public platform, or by such tests as can be publicly applied." For the same reason direct money-tests are always objected to by experienced magnetizers, the excitement produced by the knowledge of the stake or the importance of the particular test impairing or destroying the lucidity. This is the reason why gentlemen and physicians like Prof. Gregory, Major Buckley, and Dr. Haddock, who have had the command of clairvoyants, have not attempted to gain the bank-notes which have at various times been offered. Dr. Carpenter was very irate because I suggested at Glasgow—not as he seems to have understood that there *was* no note in Sir James Simpson's envelope—but that the clairvoyants themselves, if they heard of it, might very well be excused if they thought it was a trick to impose upon them. I find now that in the other case quoted by Dr. Carpenter—the note for one hundred pounds publicly stated to have been inclosed by Sir Philip Crampton in a letter, and placed in a bank in Dublin, to become the property of any clairvoyant who should read the *whole of it*—this was actually the case. After six months the letter was opened, and the manager of the bank certified that it contained no note at all, but a blank check! The correspondence on the subject is published in the "Zoist," vol. x., p. 35. Dr. Carpenter's indignation was therefore misplaced; for, as a medical knight in Ireland did actually play such a trick, the mere supposition, on my part, that ignorant clairvoyants might think that a medical knight in Scotland was capable of doing the same, was not a very outrageous one.

We now come to the last part of Dr. Carpenter's lecture—table-turning and spiritualism—and here there is hardly any attempt to deal with the evidence. Instead of this we have irrelevant matters put prominently forward, backed up by sneers against believers, and false or unproved accusations against mediums. To begin with, the old amusement of table-turning of fifteen or twenty years ago, with Faraday's proof that it was often caused by unconscious muscular action, is again brought to the front. Table-tilting is asserted to be caused in the same way, and an "indicator" is suggested for proving this; and the whole matter is supposed to be settled because no one, so far as Dr. Carpenter is aware, "has ever ventured to affirm that he has thus demonstrated the *absence* of muscular pressure," and, "until such demonstrations shall have been given, the tilting—like the turning—of tables may be unhesitatingly attributed to the unconscious muscular action of the operators." We suppose Dr. Carpenter will shield himself by the "thus" in the above sentence, though he knows very well that a far more complete demonstration of the absence of muscular pressure than any indicator

[1] Dr. Carpenter says that "the unsealing of letters and the resealing them so as to conceal their having been opened" are practised in Continental post-offices. No doubt this can be done with an ordinary letter, but it is no less certain that there are many ways of securing a letter which absolutely preclude its being done undetected, and Dr. Carpenter omits to state that such precautions are here expressly mentioned by Prof. Gregory as having been used in these experiments.

could afford has been repeatedly given, by motion, both turning and tilting, of the table occurring *without any contact whatever*. Thus, in the Report of the Committee of the Dialectical Society, we have (p. 378), Experiment 13, nine members present; all stood quite clear of the table, and observers were placed under it to see that it was not touched, yet it repeatedly moved along the floor, often in the direction asked for. It also jerked up from the floor about an inch. This was repeated when all stood two feet from the table. Experiment 22. Six members present, the same thing occurred under varied conditions. Experiment 38 (p. 390). Eight members present; the conditions were most rigid; the chairs were all turned with their backs to the table at a foot distant from it; every member present knelt on his chair *with his hands behind his back;* there was abundance of light, yet, under these test-conditions, the table moved several times in various directions, visible to all present. Finally, the table was turned up and examined, and found to be an ordinary dining-table with no machinery or apparatus of any kind connected with it. Similar movements without contact have been witnessed elsewhere and recorded by Sergeant Cox and by Mr. Crookes, as well as by many other persons; yet the man who comes before the public as the "historian" of this subject tells his audience and his readers that "he is not aware that any one affirms that he has demonstrated the absence of muscular pressure!" How are we to reconcile this statement with Dr. Carpenter's references to each of the books, papers, or letters, containing the facts above quoted or referred to? But we have evidence of a yet more conclusive character (from Dr. Carpenter's own point of view), because it is that of a medical man who has made a special study of abnormal mental phenomena. Dr. Lockhart Robertson, for many years an editor of the *Journal of Mental Science*, and Superintendent of the Hayward's Heath Asylum, declares that his own heavy oak dining-table was lifted up and moved about the room, and this not by any of the four persons present. Writing was also produced on blank paper which the medium "had not the slightest chance of touching" ("Dialectical Report," p. 248). Dr. Carpenter is always crying out for "skeptical experts," but when they come—in the persons of Robert Houdin and Dr. Lockhart Robertson—he takes very good care that, so far as he is concerned, the public shall not know of their existence. What, therefore, is the use of his asking me (in a note at p. 108) whether my table ever went up within its crinoline in the presence of a "skeptical expert?" The very fact that I *secretly* applied tests (*see* "Miracles and Modern Spiritualism," p. 134) shows that I was myself skeptical at this time, and several of my friends who witnessed the experiments were far more skeptical, but they were all satisfied of the completeness of the test. The reason why some skeptical men of science never witness these successful experiments is simply because they will not persevere. Neither Dr. Carpenter nor Prof. Tyndall would come more than once to my house to see the medium through whom these phenomena occurred, or I feel sure they might, after two or three sittings, have witnessed similar phenomena themselves. This has rendered all that Dr. Carpenter has seen at odd times during so many years of little avail. He has had one, or at most two sittings with a medium, and has taken the results, usually weak or negative, as proving imposture, and then has gone no more. Quite recently this has happened with Dr. Slade and Mrs. Kane; and yet this mode of inquiry is set up as against that of men who hold scores of sittings for months together with the same medium; and, after guarding against every possibility of deception or delusion, obtain results which seem to Dr. Carpenter incredible. Mr. Crookes had a long series of sittings with Miss Kate Fox (now Mrs. Jencken) in his own house, and tested the phenomena in every way his ingenuity could devise. Dr. Carpenter was recently offered the same facilities with this lady and her sister, but as usual had only one sitting. Yet he thinks it fair and courteous to make direct accusations of imposture against both these ladies. He revives the absurd and utterly insufficient theory that the "raps" are produced by "a jerking or snapping action of particular tendons of either the ankles, knees, or toes." The utter childishness of this explanation is manifest to any one who has heard the sounds through any good medium. They vary from delicate tickings to noises like thumpings with the fist, slappings with the hand, and blows with a hammer. They are often heard loudly on the ceiling or on a carpeted floor, and heard as well as felt on the backs or seats of chairs quite out of reach of the medium. One of the skeptical committees in America tested the Misses Fox by placing them barefooted on pillows, when the "raps" were heard as distinctly as before on the floor and walls of the room. Mr. Crookes states that he has heard them on the floor, walls, etc., when Miss Fox was suspended in a swing from the ceiling, and has felt them on his own shoulder.

He has also heard them on a sheet of paper suspended from one corner by a thread held between the medium's fingers. A similar experiment was tried successfully by the Dialectical Committee ("Report," p. 383). At a meeting of the same committee raps were heard on a book while in the pocket of a very skeptical member; the book was placed on the table, and raps were again heard; it was then held by two members supported on ivory paper-knives, when raps were still heard upon it ("Report," p. 386).

Again, there is the evidence of Prof. Barrett, an experienced physicist, who entered on this inquiry a complete skeptic. He tells us that he examined the raps or knockings occurring in the presence of a child ten years of age—that in full sunlight, when every precaution to prevent deception had been taken—still the raps would occur in different parts of the room, entirely out of reach of the child, whose hands and feet were sometimes closely watched, at other times held. The phenomena have been tested in every way that the ingenuity of skeptical friends could devise; and as Prof. Barrett is well acquainted with Dr. Carpenter's writings on the subject and the explanations he gives, we have here another proof of the utter worthlessness of these explanations in presence of the facts themselves.

The Hon. R. D. Owen has heard, in the presence of Miss Fox, blows as if made by a strong man using a heavy bludgeon with all his force, blows such as would have killed a man or broken an ordinary table to pieces; while on another occasion the sounds resembled what would be produced by a falling cannon-ball, and shook the house ("Debatable Land," p. 275); and Dr. Carpenter would really have us believe that all these wonderfully varied sounds under all these test-conditions are produced by "snapping tendons."

But what is evidently thought to be the most crushing blow is the declaration of Mrs. Culver given at length in the appendix. This person was a connection of the Fox family, and she declared that the Misses Fox told her how it was all done, and asked her to assist them in deceiving the visitors; two gentlemen certify to the character of Mrs. Culver. The answer to this slander is to be found in Capron's "Modern Spiritualism," p. 423. Mr. Capron was an intimate friend of the Fox family, and Catherine Fox was staying with him at Auburn, while her sisters were at Rochester being examined and tested by the committee. Yet Mrs. Culver says it was Catherine who told her that "when her feet were held by the Rochester committee the Dutch servant-girl rapped with her knuckles under the floor from the cellar." Here is falsehood with circumstance; for, first, Catherine was not there at all; secondly, the committee never met at the Foxes' house, but in various public rooms at Rochester; thirdly, the Fox family had no "Dutch servant-girl" at any time, and at that time no servant-girl at all. The gentlemen who so kindly signed Mrs. Culver's certificate of character did not live in the same town, and had no personal knowledge of her; and, lastly, I am informed that Mrs. Culver has since retracted the whole statement, and avowed it to be pure invention (*see* Mrs. Jencken's letter to *Athenæum*, June 9, 1877). It is to be remarked, too, that there are several important mistakes in Dr. Carpenter's account. He says the "deposition" of Mrs. Culver was made not more than *six* years ago, whereas it was really *twenty-six* years ago; and he says it was a "deposition before the magistrates of the town in which she resided," by which, of course, his readers will understand that it was on oath, whereas it was a mere statement before two witnesses, who, without adequate knowledge, certified to her respectability![1]

[1] Since the MS. of this article left my hands, I have seen Dr. Carpenter's letter in the *Athenæum* of June 16th, withdrawing the charges founded on the declaration of Mrs. Culver, which, it seems, Dr. Carpenter obtained from no less an authority than Mr. Maskelyne! the great conjurer and would-be "exposer" of spiritualism. He still, however, maintains the validity of the explanation of the "raps" by Prof. Flint and his coadjutors, who are said to have proved that persons who have "trained themselves to the trick" can produce an "*exact imitation*" of these sounds. This "exact imitation" is just what has never been proved, and the fact that a "training" is admitted to be required does not explain the sudden occurrence of these sounds as soon as the Fox family removed temporarily to the house at Hydesville. If Dr. Carpenter would refer to better and earlier authorities than Mr. Maskelyne and M. Louis Figuier, he would learn several matters of importance. He would find that Profs. Flint, Lee, and Coventry, after one hasty visit to the mediums, published their explanation of the "raps" in a letter to the *Buffalo Commercial Advertiser*, dated February 17, 1851, *before* making the investigation on the strength of which they issued their subsequent report, which, therefore, loses much of its value, since it interprets all the phenomena in accordance with a theory to which the reporters were already publicly committed. On this scanty evidence we are asked to believe that two girls, one of them only nine years old, set up an imposture which for a long time brought them nothing but insult and abuse, subjected their father to public rebuke from his minister, and made their mother seriously ill; and that they have continuously maintained the same for nearly thirty years, and in all this long period have never once been actually detected. But there are facts in the early history of these phenomena which *demonstrate* the falsehood of this supposition, but which Dr. Carpenter, as usual, does not know, or, if he

This is an example of the reprehensible eagerness with which Dr. Carpenter accepts and retails whatever falsehoods may be circulated against mediums; and it will be well to consider here two other unfounded charges which, not for the first time, he brings forward and helps to perpetuate. He tells us that "the 'Katie King' imposture, which had deluded some of the leading spiritualists in this country, as well as in the United States, was publicly exposed." This alleged exposure was very similar to that of Mrs. Culver's, but more precise and given on oath—but the oath was under a false name. A woman whose name was subsequently discovered to be Eliza White declared that she had herself personated the spirit-form at several stated *séances* given by the two mediums Mr. and Mrs. Holmes, she having been engaged by them for the purpose; and she described a false panel made in the back of the cabinet by which she entered at the proper time from a bedroom in the rear. But Colonel Olcott, a gentleman connected with the New York daily press, has proved that many of the particulars about herself and the Holmeses stated in Mrs. White's sworn declaration are false, and that she is therefore perjured. He has also proved that her former character is bad; that the photograph taken of "Katie King," and which she says was taken from her, does not the least resemble her; that the cabinet used had no such movable panel as she alleged; that the Holmeses' manifestations went on just the same on many occasions when she was proved to be elsewhere; that she herself confessed she was offered a thousand dollars if she would expose the Holmeses; and, lastly, that in Colonel Olcott's own rooms, under the most rigid test-conditions, and with Mrs. Holmes only as a medium, the very same figure appeared that was said to require the personation of Mrs. White. The full details are given in Colonel Olcott's "People from the Other World," pp. 425–478.

Another alleged exposure is introduced in the following terms: "I could tell you the particulars, in my possession, of the detection of the imposture practised by one of the most noteworthy of these lady mediums in the distribution of flowers . . . these flowers having really been previously collected in a basin up-stairs and watered out of a decanter standing by—as was proved by the fact that an inquisitive skeptic having furtively introduced into the water of the decanter a small quantity of ferrocyanide of potassium, its presence in the 'dew' of the flowers was afterward recognized by the appropriate chemical test (a per-salt of iron) which brought out Prussian blue."

In his article on the "Fallacies of Testimony," in the *Contemporary Review* of January, 1876, where Dr. Carpenter first gave an account of this alleged exposure, it is stated that "a basinful of these flowers (hollyhocks) was found in a garret with a decanter of water beside it," that the ferrocyanide was mixed with this water, and that all this was not hearsay, but a statement in writing in the hand of the "inquisitive skeptic" himself. It turns out, however, that this part of the statement was wholly untrue, as we know on the authority of a letter written by the lady of the house, and afterward published, and Dr. Carpenter now seems to have found this out himself; but, instead of withdrawing it wholly (as in common fairness he ought to have done), he still retains it ingeniously modified into an *inference*, but so worded as to look like the statement of a *fact;* "these flowers having *really* been previously collected in a basin," etc.—"as was proved"—not by finding them, but by the chemical test! What an extraordinary notion Dr. Carpenter must have of what is "really" proof! Let us, however, look a little further into this matter, of which more is known than Dr. Carpenter adduces, or than he thinks advisable to make public. Dr. Carpenter's informant was a member of the family in whose house the medium was staying as a guest. He had therefore full knowledge of the premises and command over the servants, and could very easily have ascertained such facts as the bringing of a large bunch of hollyhocks, asters, laurels, and other shrubs and flowers, into one of the visitors'

knows, does not make public. These facts are, first, that two previous inhabitants of the house at Hydesville testified to having heard similar noises in it; and, secondly, that on the night of March 31, 1848, Mrs. Fox and the children *left the house*, Mr. Fox only remaining, and that during all night and the following night, in presence of a continual influx of neighbors, *the "raps" continued exactly the same as when the two girls were present.* This crucial fact is to be found in all the early records, and it is surprising that it can have escaped Dr. Carpenter, since it is given in so popular a book as Mr. R. Dale Owen's "Footfalls on the Boundary of Another World" (p. 209). Mr. Owen visited the spot, and obtained a copy of the depositions of twenty-one of the neighbors, which was drawn up and published a few weeks after the events. This undisputed fact, taken in connection with the great variety of sounds—varying from taps, as with a knitting-needle, to blows, as with a cannon-ball or sledge-hammer—and the conditions under which they occur—as tested by Mr. Crookes and the Dialectical Committee, completely and finally dispose of the "joint-and-tendon" theory as applicable to the ascertained facts. What, therefore, can be the use of continually trying to galvanize into life this thoroughly dead horse, along with its equally dead brother the table-turning "indicator?"

bedrooms, and whether they disappeared from the room when the lady medium left it previous to the *séance*. This would have been direct evidence, and easily attainable by one of the family, but none such is forthcoming; instead of it we have the altogether inconclusive though scientific-looking chemical test. For it is evident that the flowers which appear must be brought from somewhere, and may naturally be brought from the shortest distance. If there are flowers in the house, these may be brought—as a baked apple was actually brought when an apple was asked for, according to one of the reports of this very *séance*; and if a skeptic chooses to put chemicals with such flowers or baked apples beforehand, these chemicals may be detected when the flowers or apples are examined. The wonder of such *séances* does not at all lie in where the flowers are brought from, but in the precautions used. The medium's hands, for instance, are always held (as they were in this instance), yet when thus held the flowers drop on to the table, and even particular flowers and fruits drop close to the persons who ask for them. This is the real fact to be explained when, as in this case, it happens in a private house; and the alleged chemical test has no bearing on this. But here the test itself is open to the gravest suspicion. The person who says he applied it had struck a light in the middle of the *séance*, and discovered nothing. He was, then, in consequence of some offensive remarks, asked to leave the room, or the *séance* could not go on; and subsequently high words passed between him and the medium. He is, therefore, not an unbiased witness, and to support a charge of this kind we require independent testimony that the chemical in question was not applied to the flowers *after* they appeared at the *séance*. This is the more necessary as we have now before us the statement in writing by another resident in the house that some of the flowers were sent to a medical man in the town, and that no trace of ferrocyanide of potassium could be detected. The accuracy of the supposed tests is also rendered very doubtful by another fact. In the published account of the affair in the *Bath and Cheltenham Gazette*, indorsed by Dr. Carpenter's informant (in a letter now before me) as being by a friend of his and substantially correct, it is stated that the "same authority" who is said to have "demonstrated the presence of potassium ferrocyanide" on the flowers also examined some sand which fell on the table at the same sitting, and found it to contain salt, and therefore to be sea-sand, and to agree microscopically with the sand from a sea-beach near which the medium had been staying a few days before. This reads very like truth, and looks very suspicious, but it happens that another gentleman who was present at the *séance* in question took away with him some of the sand for the purpose of subjecting it to microscopic examination; and from that gentleman—Mr. J. Traill Taylor, editor of the *British Journal of Photography*, and an occasional contributor to other scientific journals—I have received the following note on the subject: "I remember the *séance* to which you have alluded, and which was held on the evening of August 23, 1874, during the Belfast Meeting of the British Association, which I was attending. At that time, among other by-pursuits, I was engaged in the microscopical examination of sand of various kinds, and I omitted no opportunity of procuring samples. During my visit to Ireland I obtained specimens from the sea-coast of Counties Down and Armagh, as well as from the shores of Lough Neagh. When the shower of sand fell upon the table during the *séance* I appropriated a quantity of it for subsequent examination. The most careful inspection under the microscope satisfied me that it was absolutely identical with some that had been procured from the Antrim coast of Lough Neagh, while it differed in certain respects from that obtained at the sea-coast. Having subsequently seen a communication on this subject in the *English Mechanic* (by a writer who, I believe, had not been present at the *séance*), the purport of which was that the *séance* sand was similar to some obtained from a part of the sea-coast where the medium had been recently residing, I again subjected these various sands to microscopical examination, only to be confirmed in my previous conclusion. I followed this by a chemical test, as follows: I washed each sample of sand in a test-tube with distilled water, to which I then added a solution of nitrate of silver. A precipitate of chloride of silver was obtained from all the samples of sea-sand, but no precipitate was formed by that which came from Lough Neagh nor by that obtained at the *séance*, which last, under this chemical test, behaved in a manner precisely similar to the Lough Neagh sample. I recollect that the result of this test was my feeling sure that the writer to whom I have alluded had not had the same data as those in my possession for arriving at a conclusion. In about a year after that time I threw away over a dozen different samples of sand, including those to which I have referred, as I required for another purpose the boxes in which they were kept."

This clear and precise statement demonstrates the untrustworthiness of the authority on whom Dr. Carpenter relies, even if it does not indicate his disposition to manufacture evidence against the medium in question. At all events, with the more complete account of the whole episode now before them, our readers will, we are sure, admit that the evidence is by no means free from suspicion, and is quite insufficient to justify its being used to support a public charge of deliberate imposture. It also affords another example of how Dr. Carpenter jumps at explanations which are totally inapplicable to the facts in other cases, as, for example, to the production of flowers and ferns in my own room, as narrated in my "Miracles and Modern Spiritualism," page 164, and to that in the house of Mr. T. Adolphus Trollope, as given in the "Dialectical Report," pages 277 and 372, in which case the medium had been carefully searched by Mrs. Trollope before the *séance* began.

We have now only to notice the extraordinary appendix of *pièces justificatives*, which, strange to say, prove nothing, and have hardly any bearing on the main questions at issue. We have, for instance, six pages of extracts on early magic, the flagellants, and the dancing-mania; followed by four pages about Mesmer; then an account of Mr. Lewes's experiments before the Medical School, Aberdeen, which failed; then eight pages on the effects of *suggestion* on hypnotized patients —effects thoroughly known to every operator, but having no bearing on the case of persons never hypnotized or mesmerized, and to whom *no suggestion* was made; after this come ten pages on the planchette, on which no one relies without collateral evidence; and then an account of some foolish clergymen, who thought they had direct proof of Satanic agency; then comes Mrs. Culver's statement (called a "deposition before magistrates" in the text), to which we have already referred; then my own letter to the *Spectator* about Mr. G. H. Lewes's supposed proof of the imposture of Mrs. Hayden; then the oft-told story of Dr. Carpenter's interviews with Foster, from the *Quarterly Review* article; then more of Mr. Braid's "suggestion-and-expectancy" experiments—and that is all. Not one solitary piece of careful investigation or unimpeachable evidence in these forty-two pages of what are announced as *pièces justificatives!*

Let us now summarize briefly the results of our examination of Dr. Carpenter's book. We have given a few examples of how he has misrepresented the opinions of those opposed to his theories. Although he professes to treat the subject historically, we have shown how every particle of evidence is ignored which is too powerful to be explained away. As examples of this we have referred, in more or less detail, to the denial by high authorities of the reality of painless surgical operation during the mesmeric sleep; to the "Report of the Académie Royale de Médecine," supporting the reality of clairvoyance and the other higher phenomena of mesmerism; to experiments on clairvoyance before French medical skeptics; to the evidence of educated and scientific men in Vienna, as to the truth of Reichenbach's observations; to the personal evidence of Robert Houdin, Prof. Gregory, Dr. Mayo, Dr. Haddock, Dr. Lee, Dr. Ashburner, Dr. Rostan, Dr. Teste, and Dr. Esdaile, as to tests demonstrating the reality of clairvoyance; to the evidence of the Dialectical Committee, of Dr. Lockhart Robertson, Sergeant Cox, Mr. Crookes, and myself, as to motion of solid bodies demonstrably not caused by muscular action; to the evidence of the Dialectical Committee, of the Hon. Robert Dale Owen, Mr. Crookes, and Prof. Barrett, as to raps demonstrably not caused by the muscles or tendons of the medium; to the evidence of Mr. T. A. Trollope and myself as to the production of flowers, demonstrably not brought by the medium—all of which evidence, and everything analogous to it, is totally ignored by Dr. Carpenter. Again, this work, professing to be "scientific," and therefore accurate as to facts and precise as to references, has been shown to be full of misstatements and misrepresentations. As examples, we have the statement that there is no evidence of the mesmerizer's power to act on a patient unconscious of his wish to do so, whereas I have shown that there is good medical evidence of this power; that Reichenbach did not submit his subjects to tests, whereas I have quoted many admirable tests, as well as the independent test-observations of Dr. Charpignon; that Rutter's magnenometer never acted when the operator did not know the substance influencing it, whereas Mr. Rutter states clearly and positively that it did; that the Royal Academy of Medicine *first* investigated clairvoyance in 1837 and declared it not proved, whereas they first investigated it in 1825, and reported *favorably;* that Prof. Gregory was credulous, and took no precautions against imposture, which I have shown to be not the fact. Again we have numerous errors and misstatements (always against the mediums) in the accounts of the Misses Fox and Mrs. Culver, of the alleged

"Katie King" exposure, and of the flower-*séance* chemically exposed. And, lastly, we have the statement, repeated under many forms, that when adequate investigation has taken place, and especially when "trained experts" have been employed, trick or imposture has *always* been discovered. But this I have shown to be the grossest of all misstatements. Surely medical men are "trained experts," and we have nine members of the Royal Academy of Medicine investigating for five years, and a large number of French and English medical men devoting years of inquiry to this subject, and deciding that it is *not* imposture. Are not eminent physicists trained experts, so far at least as the purely physical phenomena are concerned? But we have Prof. Hare, Prof. Gregory, and Mr. Crookes, who all devoted years of careful investigation to the subject; Prof. Barrett, who has come to it with a fresh and skeptical mind, stored with all the warnings that Dr. Carpenter can give him, and yet declares it to be reality, and neither imposture nor delusion; while another recent convert from extreme skepticism on this subject is Dr. Carter Blake, Lecturer on Comparative Anatomy at Westminster Hospital, who last year wrote me that, after months of careful examination, he was satisfied that the phenomena called "spiritual" are thoroughly genuine and worthy of scientific examination; that he has arrived at this conclusion very slowly, and, referring to his recent investigations, he says: "Every experiment performed has been under the most rigorous test-conditions, and the dishonest element which some professional mediums have shown has been rigorously eliminated." Yet, again, professional conjurers are surely "trained experts," and Dr. Carpenter has himself often referred to them as such, but the moment they go against him he ignores them. I have adduced, for the second time, the remarkable evidence of Robert Houdin to the reality of the clairvoyance of Alexis; Mr. T. A. Trollope informs us that another celebrated conjurer, Bosco, "utterly scouted the idea of the possibility of such phenomena as I saw produced by Mr. Home being performed by any of the resources of his art;" and, lastly, at Glasgow, last year, Lord Rayleigh informed us that he took with him a professional conjurer to Dr. Slade's, that the phenomena happened with considerable perfection, while "the conjurer could not form the remotest idea as to how the effects were produced."

We have now concluded what has been a painful task; but in the interests of truth it was necessary to show how completely untrustworthy is the self-appointed guide that the public so blindly follow. By ample references I have afforded to such of my readers as may be so inclined the means of testing the correctness of my charges against Dr. Carpenter; and if they do so they will, I feel convinced, not only lose all faith in his explanations of these phenomena, but will also find how completely ignorant of this, as of most scientific subjects, are those writers in our influential literary press who have, almost without exception, praised this book as a fair and complete exposition of the subject on which it treats.

It also seems to me that an important question of literary morality is here involved. While maintaining as strongly as any one that new or disputed theories should be subjected to the fullest and severest criticism, I yet hold that this should not involve either misrepresentation or what has been termed the "conspiracy of silence." It is, at the best, hard enough for new truths to make their way against the opposing forces of prepossession and indifference; and, bearing this in mind, I would ask whether it is in the interests of human progress and in accordance with right principles, that those who have the ear of the public should put forth, under the guise of impartial history, a thoroughly one-sided and erroneous account of a disputed question. It may be said that errors and misstatements can be exposed, and will only injure the author of them; but, unfortunately, this is not so. The popular view of a subject like this is sure of a wide circulation, and writers in the daily and weekly papers increase its publicity, whereas few read the answer, and the press decline or refuse to make it known.[1] As the very existence of the press depends on popularity, this is inevita-

[1] A striking proof of this statement has been quite recently furnished us. The letter given below was sent by Dr. Slade to Prof. E. R. Lankester. It would seem to exhibit, in a high degree, the characteristics of truth, fairness, and charity. No answer was received. The press, moreover, refused to publish it, and the daily press, one and all, *refused to insert it even as an advertisement!*

"*Prof.* E. R. LANKESTER—

"DEAR SIR: Dr. Slade, having in some measure recovered from his very severe illness, and his engagement to St. Petersburg having been postponed (by desire of his friends there) till the autumn, desires me to make the following offer:

"He is willing to return to London for the express and sole purpose of satisfying you that the slate-writing occurring in his presence is in no way produced by any trickery of his. For this purpose he will come to your house unaccompanied by any one, and will sit with you at your own table, using your own slate and pencil: or, if you prefer to come to his room, it will suit him as well.

ble; but it none the less throws a great responsibility on those who possess this popularity if they mislead public opinion by inaccuracy or suppression of facts.

In his article on "Fallacies of Testimony" Dr. Carpenter, quoting Schiller, says that the "real philosopher" is distinguished from the "trader in knowledge" by his always loving truth better than his system. If our readers will carefully weigh the facts now laid before them, they will be able to decide how far Dr. Carpenter himself belongs to the first or to the second of these categories.—*Quarterly Journal of Science.*

"In the event of any arrangement being agreed upon, Slade would prefer that the matter should be kept strictly private.

"As he never can guarantee results, you shall give him as many as six trials, and more if it shall be deemed advisable.

"And you shall be put to no charge or expense whatever.

"You on your part shall undertake that during the period of the sittings, and for one week afterward, you will neither take, nor cause to be taken, nor countenance, legal proceedings against him or me.

"That if in the end you are satisfied that the slate-writing is produced otherwise than by trickery, you shall abstain altogether from further proceedings against us, and suffer us to remain in England, if we choose to do so, unmolested by you.

"If, on the other hand, you are not satisfied, you shall be at liberty to proceed against us, after the expiration of one week from the conclusion of the six or more experiments, if we are still in England. You will observe that Slade is willing to go to you without witnesses of his own, and to trust entirely to your honor and good faith.

"Conscious of his own innocence, he has no malice against you for the past. He believes that you were very naturally deceived by appearances, which, to one who had not previously verified the phenomena under more satisfactory conditions, may well have seemed suspicious.

"Should we not hear from you within ten days from this date, Slade will conclude that you have declined his offer.

"I have the honor to be, sir, your obedient servant,

"J. Simmons.

"37 Spui-straat, The Hague, *May* 7, 1877."

A STUDY OF LOWER LIFE.

As has well been observed, the phrase *omne ignotum pro magnifico* is not more appropriate or true than its reverse or opposite. And it constitutes one of the greatest advantages of natural history study, that it directs our attention to new and curious features in the commonest living forms around us, and, by aiding both our mental and physical perceptions, largely extends the range of the most commonplace observation. The "sight" of the natural historian is, in fact, any thing but "unassisted;" but, on the contrary, discerns beauty and grace where vision of the latter description could perceive nothing worthy of attention or study. If Pope's dictum that "the proper study of mankind is man," be accepted as literally true, and as tending to limit human observation to the investigation of its own peculiarities, the zoölogist may fitly remind the poet that the study of lower forms not only assists our appreciation of human affairs, but sometimes actually explains and elucidates points in man's history which otherwise would remain utterly obscure. Thus the spirit of a liberal science is most decided in its opposition to any exclusiveness in the objects submitted to its scrutiny; since, recognizing the independence of the various branches of knowledge, we learn that the advance of one study really means the improvement of all.

No better illustration of the manner in which a simple study in biology may be made to form a text for the illustration of some facts and points interesting to the world at large can well be selected, than that comprised in the life-history of the little animal known as the *Hydra*, or "common fresh-water polyp." The examination of this common denizen of our pools and ditches may convince the skeptical that the issues of scientific study are not only varied and interesting, but that they also sometimes lead us to contemplate phases of life and growth not very far removed from some of the most important problems which can well occupy the consideration of the human mind.

The hydra of the zoölogist by no means recalls to mind, as regards its form at any rate, the famous being of mythological lore; although, as will hereafter be noted, in certain of its features, the modern hydra may fitly bear comparison with its mythical namesake. If we take some water

from a quiet pool, which has become stagnant and overgrown with lower plant-life and water-weeds flourishing apace under the kindly influences of the summer sun, and place this water along with a small quantity of the weeds in a clear glass vessel exposed to the light, we may be almost sure to find that in due time certain small bodies of greenish color have attached themselves to the sides of the vessel. These bodies will congregate chiefly on the side of the vessel next the light, and, as regards their size, the beings referred to are seen to be by no means large. A length of about a quarter of an inch may be regarded as a fair statement of their average dimensions; although occasionally a specimen may greatly exceed the proportions of its neighbors, and exhibit a length of half an inch or more.

Examined by the aid of a hand-lens, each of these little organisms or hydræ is seen to possess a tubular or cylindrical body, which is attached by one extremity to the glass or duck-weed, and which exhibits at the opposite and free extremity a mouth-opening, surrounded by a circle of arms or tentacles. These latter are delicate, thread-like organs, which in the undisturbed and natural state of the animal remain outstretched in the water. In the common or green hydra, the tentacles are not disproportionately developed as regards the body, but in certain other forms or species, in which the body is colored brown (*Hydra fusca*), the tentacles are very long, and the animal obtains in consequence the distinctive name of the "Long-armed Hydra."

The observation of the common incidents of the hydra's life reveals certain interesting features, which assist us in some degree in the appreciation of the nature and structure of these organisms. When the tentacles are touched, they at once contract and shorten, and the body also shrinks or shrivels up into a somewhat rounded mass. This simple fact proves to us that the hydra is sensitive to outward impressions, a feature in its history which is of high interest when we endeavor to understand the nature and relations of the nervous system of higher animals; and that these animals are also sensitive to more delicate impressions is proved by their clustering in numbers on that side of the glass vessel which is next the light. If the hydra is left in an undisturbed condition after being irritated, the body and tentacles will become elongated and expanded, and will once more resume their normal condition.

That the polyps are not permanently rooted or attached to the weeds in which they are commonly found, may be proved by the simple observation of their habits. They may be seen to detach themselves from fixed objects, and to move slowly about in leech-like fashion, or like the looping caterpillars, by alternately fixing and extending the mouth and root-extremity of the body; while occasionally they may be seen to float listlessly, with extended tentacles, amid their native waters.

When any minute animal, such as a water-flea, or some similar organism, comes in contact with the tentacles of the hydra, an interesting series of acts is witnessed. The tentacles are then observed to act as organs for the capture of prey, the victim being seized and conveyed by their contraction toward the mouth of the animal, within which cavity it finally disappears from view. That the hydra, therefore, possesses instincts common to all forms of animal life, high and low alike, and which lead it to supply the wants of its frame, cannot be doubted; and Schiller's maxim that hunger is one of the powers that rule the universe, may thus be aptly illustrated within the small domain and in the simple life-history of the hydra.

As might be expected, the prey at first struggles violently to escape from the clutches of its captor, but after a short period the efforts become less and less marked, and the captive may be noted to become somewhat suddenly helpless and paralyzed. The observation of these details leads us to expect that the hydra possesses some offensive apparatus, through the action of which the capture of prey is facilitated. And an examination, by aid of the microscope, of the tentacles of the polyp, and in fact of its body-substance as well, would reveal the presence of numerous minute capsules, named "thread-cells," which are developed in the tissues of the body. Each of these curious little cells consists of a tough outer membrane, within which a delicate thread or filament lies coiled up amid fluid. When one of these structures is irritated, as by pressure, the cell is observed to rupture, the thread being thrown out or everted, while the fluid at the same time escapes. A thread-cell of the hydra, in its ruptured condition, appears as an oval capsule having attached to one extremity the thread, which is provided at its base with three little spines or hooks. The consideration of the structure and functions of these thread-cells clearly indicates their offensive nature. Each may in fact be regarded as representing a miniature poison-apparatus; the "thread" being the dart or sting, and the fluid constituting the

venom. The prey of these polyps has little chance of escape from the attack of these cells; since wounded by the threads, which doubtless become attached to its body by the hooks, and poisoned by the fluid, even animals of tolerably large size, when compared with the hydra, may be seen to succumb to its attack. The polyps are thus seen to be singularly well provided as regards offensive apparatus, the particular form and action of which remind one, in some degree, of the famous "lasso" of Western nations. And it is at the same time interesting to note that thread-cells of essentially similar nature to those found in the hydra confer on the jelly-fishes and allied forms the stinging powers which render these beings the terror of tender-skinned bathers.

The internal structure of our polyp is of the simplest possible description. It may seem strange to talk of an animal body which lives and grows without any of the structures or machinery we are accustomed to associate with the higher animals. Yet the hydra exemplifies the former condition; since we might accurately enough describe its body as consisting of a simple tube, the interior of which contains no organs of any kind, and which communicates with the outer world through the mouth. If we further suppose that the walls of this tubular body are composed of two closely-applied layers or membranes—the outer somewhat dense and tough, and the inner of more delicate nature—we shall have formed a broad but accurate idea of the constitution of these polyps. When the prey or food is swallowed, it therefore passes into the interior of the tubular body, which evidently serves as a stomach-sac. Here the morsel is digested or dissolved, and, as the result of this process, a fluid perfectly adapted for the nourishment of the polyp is formed. This fluid or blood is kept circulating throughout the interior of the simple body, by the constant movements or vibrations of numerous minute processes named *cilia*, which exist like a fringe on the lining membrane of the body-cavity, and which therefore perform the functions of the heart of higher animals. Thus it may be said that every part of the hydra's body is brought directly into contact with this nutritive fluid, since we note that the fluid is transmitted from membrane to membrane and from cell to cell by the process of imbibition. And in this simple manner does the hydra repair the continual waste of its parts; this process of waste being the inevitable result of the acts and functions of every living being, and the invariable concomitant of life itself.

We have already noted that the hydra possesses the power of appreciating sensations, since it shrinks when touched, and exhibits other proofs of its sensitiveness. In the possession of this power the polyp resembles some plants, and most, if not all other animals, including man himself. Broadly stated, this power which the hydra possesses may be regarded as presenting us with the idea of a nervous system in its simplest phase. The functions of such a system may be summarized in the statement that it is adapted for bringing the animal into relation with its surroundings. We thus say that the nervous system exercises the function of "relation;" while, from the fact that the animal performs this function through impressions being made upon it, we are also accustomed to speak of the nervous power as exercising the function of "irritability." This power, in fact, stands mediately between the animal and the world in which it lives. The higher we ascend in the animal scale, the more perfectly do we find the nervous system adapted for placing the animal in possession of a knowledge of its environments; although, as will be presently remarked, the differences between the nervous powers of higher and lower animals are to be considered rather differences of degree than of kind.

But, as an examination of the hydra demonstrates to us, the view just taken of the nervous functions can hardly be considered of a complete kind. For we find that the polyp when touched is enabled to act upon the knowledge or sensation which the touch conveys; since its tentacles contract, and its whole body shrinks as if in irritation and alarm. The reception of a sensation by the nervous system is therefore accompanied by a power of acting upon "information received;" and it cannot be doubted that a certain and definite correspondence must exist between the impression and the act it evokes. Indeed, among lower forms of animal life this correspondence is not only exceedingly well marked, but constitutes in itself the sum total of the nervous functions in such beings. But the highest animals, including man himself, may be said to acquire a knowledge of their surroundings in an exactly similar manner. When we talk of exercising our senses—or when, to use a comprehensive term, we speak of "feeling"—we are simply expressing the idea of obtaining a certain knowledge of our environments, and as a result we are further enabled to act upon that knowledge in ways and fashions relative thereto.

Some such ideas as those just stated have

given rise to the conception—widely known and discussed in these days under the name of the "automatic doctrine"—that the acts of all animals, including those of man—"the paragon of animals," as *Hamlet* terms him—bear in reality a much closer relation to their surroundings than they are generally supposed to possess. The simple acts of a hydra's life, and the most intricate operations of the human mind; the nervous action which enables a polyp to obtain a particle of food; and the nerve-changes evolving thoughts which emanate from minds like those of Goethe, Shakespeare, Newton, and Milton—thoughts which will reëcho in the minds of men throughout all time—are thus held to present, when analyzed out to their fullest extent, a striking community of origin. The polyp is said to be really an "automaton," in that it simply acts through its nervous powers, as these powers are first acted upon by outer impressions; and man, we are told, must also be held as sharing this automaton nature, since his acts are determined in like manner by outward circumstances, and simply by the succession or order in which these circumstances have been impressed upon his nervous centres. "The question is," as Dr. Carpenter has expressed it, "whether the Ego is completely under the necessary domination of his original or inherited tendencies modified by subsequent education, or whether he possesses within himself any power of directing and controlling these tendencies." Or as the case is put by Prof. Huxley: "Descartes's line of argument is perfectly clear. He starts from reflex action in man, from the unquestionable fact that in ourselves coördinate purposive actions may take place without the intervention of consciousness or volition, or even contrary to the latter. As actions of a certain degree of complexity," continues Huxley, "are brought about by mere mechanism, why may not actions of still greater complexity be the result of a more refined mechanism?"

As may readily be noted, this theory of the physical origin of man's mental powers necessarily carries with it a special and peculiar interpretation of man's moral nature and obligations. For it implies the belief that we cannot act in any other fashion than is determined by our character; and this latter, in its turn, results from or is developed by the action of outer and physical circumstances upon the organism. Consciousness, or that knowledge of *self* which most people hold lies at the root and foundation of our mental existence, except as a secondary matter, is thus put altogether out of court; and the powers of mind come in this view to represent so many effects of the long-continued action of experience and custom in inducing various mental states as the result of certain combinations of outer impressions.

The fierce conflict to which the discussion of this automatic doctrine has given rise can be readily understood and explained. It is no light matter to assert that the mental powers and intellect of man are, after all, simply material in their nature and origin, and that they merely represent a high development and modification of the simple nervous impressions seen in lower states of existence. Yet there is a latent truth in this view of the matter, which, when recognized and brought into relation with facts and ideas external to such a theory, presents us with a rational explanation of the origin of man's mental nature. Whatever may have been the origin of man's intellect, there can firstly be no question of the impassable nature of the gulf which exists between the human type of mind and the instincts of all other forms of life. Even if man's total origin from a lower form or forms were a proved fact, the recognition of the fact could never lessen by an iota our estimation of the infinite superiority of man, regarded as a thinking, intelligent being, over his nearest allies. Preconceived notions and ideas might, and probably would, revolt against such an idea of the origin of man's mind; but the spirit of a liberal science would content itself with the fact that no considerations regarding its origin and development can detract from the high or immeasurable superiority of the human over every other type and form of nervous functions.

Turning next to inquire into the existence of automatic or instinctive acts among animals, we may, in the first place, be surprised to note that in the hydra, sensitive although the polyp is seen to be to outward impressions, no traces of a nervous system or of analogous organs can be discerned. The polyps are thus literally sensitive, without possessing any appreciable or visible apparatus for exercising that sense. The hydra is, however, by no means alone in this respect. The sea-anemones, which are animals nearly related to the hydra, are equally as sensitive as, if not more so than, the latter, since the anemones may be seen to withdraw their tentacles and to contract their bodies on being touched, or even if the light falling upon them be suddenly intercepted, as by the shadow of a passing cloud. Yet the anemones, like hydræ, utterly want a nervous

system. But certain plants may also not only exhibit symptoms of irritation or sensitiveness when touched, but may act upon their sensations —a feature well exemplified by the drooping leaflets and leaf-stalk of the sensitive-plant, by the closure of the leaf of the Venus's-flytrap, and by definite movements of contraction observed in other plants, resulting from alterations in temperature. In plants, it is almost needless to remark, no nervous system has been demonstrated to exist; and no botanist has even suggested the possibility of the existence of nervous tissues within the limits of the vegetable creation. Yet, tested by the acts of their lives, we might truly say to such plants, with Shakespeare—

> ". . . . sense you have,
> Else could you not have motion;"

and, judging from the sensitiveness of the plants just mentioned, the conclusion appears inevitable that plants possess means for receiving and for acting upon sensations, and that in this light they may be fitly compared with the hydra and all lower animals in which a nervous system has not been demonstrated to exist.

It is perfectly clear that the acts of these plants, and of such animals as the hydra and sea-anemone, must be considered of a purely automatic kind. We cannot reasonably suppose that consciousness, or a knowledge of why or how the acts are performed, plays any part in the life-history of such forms. And, even if it be maintained that mere sensation and consciousness in this case are identical or closely allied, the latter quality must be so far removed in its nature from the consciousness of humanity as to render the comparison quite inadmissible. The hydra and its neighbors are in truth automata pure and simple, in that they are stimulated by outward circumstances and respond to such stimuli without possessing any appreciation of the why and wherefore of any act of their lives.

But that automatic acts may represent the whole life, or a very large share of the actions, of animals much higher than these polyps, can readily be demonstrated. A centipede, for example, when cut in halves, will exhibit lively and independent movements in each half of its body—a fact readily explained when we note that each joint of the animal's body possesses a nervé-centre which supplies the surrounding parts with powers of movement. And, if the central portion of the nervous system of the animal be destroyed while its body remains intact, the front portion of the body and the front-legs together with the legs lying behind the destroyed portion will continue to push the animal forward. Here the action of the hinder legs is purely automatic. But in the insect-class we find many examples of automatic acts, which at first sight actually seem to suggest the development of a high intelligence. The young insect, just liberated from its chrysalis state, performs at once and perfectly all the operations of its life. And even in the case of the wonderful operations exemplified by the ants, bees, and their allies, we find examples of automatism. The acts of these insects are in reality determined by surrounding conditions; and each insect, destitute of all previous knowledge, enters upon its duties and discharges them with unerring skill, immediately after its birth or when it has attained its full development. Here, therefore, there can be no intelligent appreciation or consciousness of the nature of the duties performed. Indeed, as Dr. Carpenter has well remarked in speaking of the adaptation of such insects to their duties, "the very perfection of the adaptation, again, is often of itself a sufficient evidence of the unreasoning character of the beings which perform the work; for, if we attribute it to their own intelligence, we must admit that this intelligence frequently equals, if it does not surpass, that of the most accomplished human reasoner."

Turning lastly to the investigation of man's actions as a type of those of higher animals generally, we find that physiology makes us acquainted with the performance of many automatic acts and movements in the common existence of humanity. The earliest acts of the infant are purely automatic; they are performed without the slightest appreciation of their meaning, and without any intelligent conception of their order and succession, that order and succession being really determined by the outward or physical conditions of life. The person who walks along the street absorbed in a reverie or day-dream, but who nevertheless and all unconsciously to himself avoids his neighbors and the lamp-posts, is so far an automaton in that the complicated muscular movements of his limbs and the general equilibrium of the body are being coördinated independently of his knowledge and will. And very many other examples might be cited in support of the allegation that automatic acts and movements play a very important part in the existence of higher animals.

Thus we may hold it to be fully proved that automatism has a veritable existence, and really

forms the basis of all nervous acts. That in itself it constitutes the essence of all the intellectual acts of man is, however, a conclusion by no means involved in the preceding statement. That the "physical" act involved in the execution of any movement—such an act being exemplified by the change which nerve-tissue undergoes even in the act of thinking—is connected and associated with another action, the "mental" act, cannot be doubted, if it be admitted at all that we possess a rational cognizance of ourselves and our actions. And that the "mental" act in the higher animal may represent the actual source, origin, and cause, of the physical act, is also, as far as human intelligence can assure us, an undoubted fact. Hence we are forced to conclude that, however this mental act has originated in man, it has really come to assume a place, dominion, and power, in the constitution and working of his nervous system which are utterly unrepresented in any lower forms. If man may be proved or believed to be hereditarily the "slave of antecedent circumstances," it must also be admitted that a new power has been developed out of the action upon his nervous system of these same circumstances, this power being represented by the formation of the conscious self-knowing Ego or Mind. That hereditary influences and inherited constitution possess a large share in moulding the mind, as they undoubtedly operate in producing a certain conformation of body, is but a reasonable belief. And the formation of the character of the child, and through the development of the latter that of the adult mind also, must accordingly depend to a certain extent upon influences for which neither is in any way responsible, and over which, in the first instance, neither can have any control. That automatic acts derived from and moulded upon preceding acts of like character make up the chief part of human existence in a savage state is a statement of readily-proved kind, since man in his primitive condition can hardly be supposed to speculate much concerning himself, but has his acts directed and controlled to a greater or less extent by outward circumstances and by the exigencies which his physical surroundings induce. But as in man's physical development, so in his mental nature, new features appear; and, explain it how we may, we are forced to recognize that out of the mere instinct and pure automatism of his earlier state have been developed that fuller knowledge and command of self which bring with them the moral sense and all the noble conceptions of his race: a progress of mental development this, imitated by the mental advance of man as he emerges from the savage to the civilized state, and typified in a closer fashion still by the growth and progress of the infant's mind, from the indefinite mists of unconsciousness to the clearer light of a rational intelligence. The development of the child's intellect in this view presents us with a panoramic picture of the stages through which we may conceive the mind of man to have passed in its progress from the condition of a hydra-like automaton to the higher phase in which he obtains a knowledge of himself. And it seems to me that only through the ideas involved in some such theory of the origin of man's mental powers can we reasonably explain the possession by lower animals of many qualities and traits of character which we are too apt to regard as peculiar to man. The community of instincts in man and lower animals, in fact, affords a powerful argument in favor of the idea that the higher intellect of humanity has originated through the progressive development of lower instincts.

Our survey of the relations and origin of nervous acts has led us far afield into the domain of metaphysics, and has in some measure alienated us from our more sober study of the commonplace hydra. We have, however, noted that our polyp forms a text for the illustration of some points highly interesting to humanity at large, and in what remains to be told of its life-history we shall find exemplified several other features of a highly-interesting if not of a most remarkable kind.

Of these latter features, probably the most notable relate to the various modes in which the hydra may reproduce its kind. We have already observed how the animal makes provision for the wants of its own existence, and how it repairs the local and continually-occurring death of its parts by the reception and digestion of food, and by the circulation from cell to cell of the products of nutrition. Such a view of the polyp's organization, however, presents us after all with a one-sided aspect; and, like most partial and incomplete surveys of things, our ideas of the polyp's life-history are apt to become erroneous and liable to misconstruction. Every living being, in addition to the duty imposed upon it of repairing its individual loss of substance, has to bear a share in the reparation of the injuries and losses which death is the means of inflicting on its species or race. Through the processes of reproduction and development, new

beings are ushered into the field of active life to take part in carrying on the life of the species, just as the process of nutrition made good the wants and supplied the exigencies of the single form.

The Harveian motto, "*omne ex ovo*," holds good in the case of the hydra, inasmuch as we find that the animal in summer more especially may be seen to produce eggs, from which, through a process of regular and defined development, new hydræ are produced. But we may concern ourselves less with this normal phase of development than with certain strange and out-of-the-way features which our polyp may be observed to exhibit. There are very few persons outside the ranks of biologists who would be inclined to associate a veritable process of "budding" with the functions of an animal organism. Yet in the hydra, in a large number of its neighbors, and in a few other groups of the animal world, a veritable process of this nature occurs, whereby from a parent-body certain portions are gradually budded out to assume in due time the form and likeness of the being which has produced them.

Thus, when the hydra is well nourished, little projections may be observed to sprout from the side of the body. As these projections increase in size, each is seen gradually to develop a mouth and little tentacles at its free end, and in due time presents us with the spectacle of a young hydra, which has budded from the parent, to which, save in size, it bears a close resemblance. Sometimes, also, it so happens that this young bud grows and multiplies like its parent, and produces a bud in its turn. So that we meet, in such a case, with a veritable genealogical tree, presenting us with three generations of hydræ, adhering to each other, and connected by the closest ties of blood-relationship. Not only, therefore, is our hydra colored like a plant: it also imitates the plant-creation in certain aspects of its life-history, and by the process of budding converts itself from a single into a compound animal. While the young buds remain attached to the parent, free and perfect communication exists between the simple body-cavities of the connected individuals, and the compound organism is thus nourished by as many mouths as there are animals in the colony. But this connected and compound state is not permanent in the hydra; although, as seen in the zoöphytes, it presents us with a complicated and enduring fabric, numbering, it may be, many hundreds of included animals which have been produced by a process of budding. Sooner or later the young hydra-buds will break contact with the parent-body, and will float away through the surrounding water on their way to root themselves to fixed objects, and to begin life on their own account.

More astonishing by far, however, is it to find that we possess the means for propagating hydræ at will. We may actually imitate the experiment performed of old by that redoubtable demi-god Hercules, since by the artificial division of one polyp we may give origin to new beings, and may multiply the species through the destruction of a single individuality. These curious results, also obtained by experimentation on the sea-anemones, were first made known to the world at large by Trembley, an Englishman, who was tutor to the sons of Count Bentinck, and who also, while resident at Geneva about the middle of the last century, contrived to find time and opportunity for close observation of those polyps. In 1744 Trembley published his memoir on the hydræ, and we shall leave the ingenious naturalist to detail in his own language the method and results of his experiments. Surprised at the curious life-history and plasticity of these creatures under almost every condition, Trembley resolved to ascertain if the reproductive powers of hydræ were further allied to those of plants in their ability to reproduce their like by being divided into "slips." Having divided a hydra crosswise and nearer to the mouth than to the root-extremity, he put the two parts into a flat glass which contained water four or five lines in depth, and in such a manner that each portion of the polyp could be easily observed through a strong magnifying-glass. "On the morning of the day after having cut the polyp, it seemed to me that on the edges of the second part, which had neither head nor arms, three small points were issuing from these edges. This surprised me extremely, and I waited with impatience for the moment when I could clearly ascertain what they were. Next day they were sufficiently developed to leave no doubt on my mind that they were true arms. The following day two new arms made their appearance, and some days after a third appeared, and I now could trace no difference between the first and second half of the polyp which I had cut."

Experimenters since Trembley's time, but following in the track of that ingenious observer, have cut and divided the hydra in almost every possible fashion, with the result of finding that the polyp possesses an unlimited power, not only of resisting injuries—the least of which would be sufficient to insure the death of any ordinary

organism, plant, or animal—but of utilizing the results of mutilation in the multiplication of its race. But, as a final feature in the hydra's history, we must allude to one point which perhaps we should deem as even of a more extraordinary kind than the traits of character just described; this point being exemplified by certain experiments of Trembley, in which he actually succeeded in turning these polyps inside out, without in the slightest degree interfering with their ultimate vitality. In 1742 Trembley first succeeded in his endeavor to place the polyp *hors de combat*, and his *ruse* or plan of procedure was of so ingenious a nature that we may again let him speak for himself. He tells us that he commenced operations "by giving a worm to the polyp, and put it, when the stomach was well filled, into a little water, which filled the hollow of my left hand. I pressed it afterward with a gentle pinch toward the posterior extremities. In this manner I pressed the worm which was in the stomach against the mouth of the polyp, forcing it to open—continuing the pinching pressure until the worm was partly pressed out of the mouth. When the polyp was in this state I conducted it gently out of the water, without damaging it, and placed it upon the edge of my hand, which was simply moistened in order that the polyp should not stick to it. I forced it to contract itself more and more, and, in doing so, assisted in enlarging the mouth and stomach. I now took in my right hand a thick and pointless boar's bristle, which I held as a lancet is held in bleeding. I approached its thicker end to the posterior extremity of the polyp, which I pressed until it entered the stomach, which it does the more easily since it is empty at this place and much enlarged. I continued to advance the bristle, and in proportion as it advanced the polyp became more and more inverted. When it came to the worm, by which the mouth is kept open on one side, and the posterior part of the polyp is passed through the mouth, the creature is thus turned completely inside out; the exterior superficies of the polyp has become the interior."

The operation thus described was occasionally frustrated in a manner by the hydræ; since, in less than an hour, Trembley observed some specimens to succeed in restoring themselves to their natural position. This observer, however, prevented the latter result in one or two instances by spitting the polyp, a needle being passed through the body close under the mouth; and when thus treated, the animal, with wisdom which humanity might sometimes advantageously imitate, accommodated itself without murmur to the exigencies of its position. Trembley appears to have taken the state of the appetite of his polyps as a very natural and rational test of their state of health after being operated upon; since he remarks that a hydra which had been turned inside out ate "a small worm two days after the operation;" while to conclude, he remarks that "the same polyp may be successively inverted, cut in sections, and turned back again, without being seriously injured." After the recital of these experiments—to which, seeing that the hydra possesses no traces of a nervous system, the most tender-hearted anti-vivisectionist could offer no objection—we may well question whether the hydra of zoölogy is not after all a more wonderful animal than its mythical and fabulous namesake.

The attentive consideration of these features in our polyp's biography naturally suggests some remarks on the nature of the beings which possess powers so wondrous of resisting mutilation and of recovering from serious injury. In virtue of what description or amount of vitality, it may be asked, or on what supposition can we account for the amazing reparative powers of the hydra? The answer to the question may be prefaced by the remark that the hydræ are not singular in respect of their fertility under apparently disadvantageous circumstances. As already remarked, and as the writer can testify from experiment, the sea-anemones may be subjected to the ordeal of trial by slicing and chopping with favorable results, as far as the artificial increase of the race is concerned. But animals occupying a much higher place in the scale of animal society may also exhibit reparative powers of a singular and extensive kind. A starfish, for example, need not in the slightest degree be disconcerted by the loss of its rays, for these astronomical beings may be met with on the sea-beach in the condition of grim old warriors who have left portions of their organization on numerous battle-fields, and possessing, it may be, but a single intact ray; the other four rays having most likely served voracious codfishes as dainty if somewhat tough morsels. Or, again, the crabs and lobsters may be cited as examples of animals to whom the loss of a limb, less or more, makes but little difference. Indeed, the lobsters seem to part with even the largest of their members on very slight provocation; for a sudden noise, such as the report of cannon, has been known to serve as the exciting cause of dismemberment. Or, lastly, to select animals of a higher grade

still, it is well known that our familiar eft or newt may lose half of its tail without suffering any permanent loss; a natural process of reparation and growth in the starfish, in the crab and lobster, and in the newt, in due time providing new members for old ones. Man in one sense may well envy the reparative powers of his inferior neighbors; since even in the comparatively small matter of teeth he has to place himself under the tender mercies of the dentist in event of loss, and must view with hopeless gaze the disappearance of the last joint of a finger or toe.

Although the physiologist is unable in the present state of his science to explain the exact and intimate manner in which the hydra and other animals reproduce their tissues, we may nevertheless, by a very homely simile, contrive to gain a broad idea of the nature of these reparative powers. We thus must firstly note that the process is simply one of nutrition, or nutritive growth carried out to a high degree of development. We are dealing in fact, in such cases, with an increase of the ordinary powers and processes whereby, as we have already stated, the bodily waste is made good. But at the same time we note that these powers and processes vary throughout the animal world, doubtless in obedience to some law which determines the closer interdependence of the different parts of animals the higher we advance in the zoölogical scale. To put the matter in its plainest light, we may compare the organization of the hydra and its neighbors to that of the "republic." The essential feature of this form of human association I take to be comprised in the broad statement that one man or member of the republic is as good as any other man or member, and that each man (theoretically) has an equal voice with his neighbor in the conduct and rule of the state. In that form of government to which the name of "limited monarchy" is applied, the leveling and equalizing tendencies of the republic are wanting. Every one person is not equal in rank or value to every other person; but, although each has theoretically his definite place and voice in the rule and management of the state, some assume a higher rank and power than others. Applying the comparison to the case before us, we can form at least an intelligent conception of the relative nature of the powers of the lower and higher animal. The hydra emphatically represents an animal democracy—a veritable republic. One part is as good as any other part, when demands are made upon it for reparation and growth; and this quality of self-support and independence, this power of existing separate from other parts, forms the feature in virtue of which the organization of the hydra becomes so plastic under the most trying conditions, and so well adapted in virtue of its inherent powers to rebuild the disorganized fabric. In man and higher animals, on the other hand, we find exemplified a form of vital government represented most nearly by the limited monarchy. Here, while each portion of the organism possesses a certain share in the constitution and management of affairs, some parts, and notably the nervous system, take precedence of and serve to unite and combine the others. The principle of regulation and interdependence thus involved simply renders it impossible for all parts to possess equal reparative powers. Hence, lost parts are not commonly replaced in higher animals, for the reason that the loss has entailed a separation from other parts, possessing no inherent powers of reproduction within themselves, and has divided the sustenance and life of the lost parts from that of the entire, connected, and interdependent system.

The process of growth and the harmonious relation of organs and parts, observed in the hydra and in most other living beings, suggest, as a final feature worthy of note, the consideration of what is implied in the growth and increase of living organisms generally. The body of the hydra was, at an early stage of our investigation, seen to be composed of tissues, and these tissues, again, to be made up of minute elements or cells. The growth of the hydra, therefore, in reality, means the increase of each of its minute parts; and, when we reflect on the law of growth thus evolved, we may be puzzled to account for or explain the intimate nature of the mysterious power which is seen to operate in controlling and directing in so remarkble a manner the functions of this humble organism. In the hydra, then, as representing a single organism, or, still better, in the zoöphyte, which consists of a colony numbering, it may be, hundreds of animals, united in a close structural relationship, or in the bodies of higher animals still, we find the principle of the perfect coöperation of many different parts to one harmonious end, namely, the maintenance of the organism, beautifully exemplified. In most of the grave affairs of life man strives to secure the cooperation of his fellows; but humanity, unfortunately for the success of its schemes, exhibits many little weaknesses and failings, and the common tendency of one mind to assert its supremacy over another may result in the demolition of the coöperative idea. Man might, therefore, well strive

to imitate the unselfish union of aims and ends which a zoöphyte colony exemplifies, or which the vital mechanism of his own tissues illustrates. When the political economist shall have succeeded in inaugurating a scheme of human coöperation for any purpose, on the successful model of Nature's colonies in lower life, he will have good cause to congratulate himself and his fellows on having solved one of the paramount difficulties which beset his day and generation.

But, lastly, the true nature of the growth of a living being can only be fully understood if we for a moment compare that process with the increase of a lifeless body. No better, truer, or more eloquent description of the differences between the growth of the living and that of the non-living could well be found than in the following passages, culled from an essay,[1] by one of the most liberal and advanced scholars of our day, intended to illustrate the progressive nature of philosophic science. "There is one kind of progress," says the writer, "which consists simply of addition of the same to the same, or of the external accumulation of materials. But increase by addition, even though it be ordered or regulated addition, is not the highest kind of advancement. Pile heap on heap of inorganic matter, and you have a result in which nothing is changed; the lowest stratum of the pile remains to the last what it was at the first; you keep all you ever had in solid permanence. Add stone to stone or brick to brick, till the house you have built stands complete from foundation to copestone; and here, though in order and system there may be a shadow of something higher than mere quantity, there is still only addition without progress. You have here also what the superficial mind covets as the sign of value in its possessions—permanent results, solid and stable reality. Every stone you place there remains to the last cut, hewed, shaped, in all its hard external actuality, what it was at the first; and the whole edifice, in its definite outward completeness, stands, it may be, for ages, a permanent possession of the world.

"But when you turn from inorganic accumulation or addition of quantities to organic growth, the kind of progress you get is altogether different. Here you never for a single day or hour keep firm possession of what you once had. Here there is never-resting mutation. What you now have is no sooner reached than it begins to slip away from your grasp. One form of existence comes into being only to be abolished and obliterated by that which succeeds it. Seed or germ, peeping bud, rising stem, leaf and blossom, flower and fruit, are things that do not continue side by side as part of a permanent store, but each owes its present existence to the annulling of that which was before. You cannot possess at one and the same time the tender grace of the vernal woods and the rich profusion of color and blossom of the later growth of summer; and if you are ever to gather in the fruit, for that you must be content that the gay blossoms should shrivel up and drop away. Yet, though in organic development you cannot retain the past, it is not destroyed or annihilated. In a deeper way than by actual matter-of-fact presence and preservation, it continues. Each present phase of the living organism has in it the vital result of all that it has been. The past is gone, but the organism could not have become what it is without the past. Every by-gone moment of its existence still lives in it, not, indeed, as it was—but absorbed, transformed, worked up into the essence of its new and higher being. And when the perfection of the organism is reached, the unity of the perfectly-developed life is one which gathers up into itself, not by juxtaposition or summation, but in a far deeper way, the concentrated results of all its by-gone history. And by how much life is nobler than dead matter, by so much are the results and fruits of life the manifestation of a nobler kind of progress than that which is got by the accumulation of things which are at once permanent and lifeless, and permanent *because* they are lifeless."

The hydra, equally with the higher animal, and the lowliest plant equally with the lordly oak, present the distinctions and differences thus forcibly expressed as existing between living and non-living matter. There is thus a constant replacement of old particles by new ones; and this change is not, after all, a mere replacement, but also includes and carries with it a process of growth and increase—of which latter, as seen in the living being, perhaps the most wonderful feature is that whereby, amid all the constant changes which living and being involve, the animal or plant should preserve and retain the form in which it was, so to speak, originally limned.

A study of the denizens of a stagnant pool may thus be shown to lead up, unconsciously it may be, but also naturally, to some matters of weighty consideration and interest, even to the

[1] "Progressiveness of the Sciences," by John Caird, D. D., Principal of Glasgow University. Glasgow: Maclehose, 1875.

most unscientific of observers. And it will be found not the least characteristic and valuable feature of all such studies, that they serve as literal starting-points and as vantage-grounds whence we may shape an intellectual course, leading us by many and diverse *radii* from limited perceptions and finite aims, outward and upward to the Infinite itself.—*Cornhill Magazine.*

THE TRIAL OF JESUS CHRIST.

By ALEXANDER TAYLOR INNES.

MEN have too much forgotten that the central event in history assumed the form of a judicial trial. The prodigious influence of the life and personality of Jesus of Nazareth is admitted by all. And his tragical death, early and passionately accepted by Christianity as the significant fact of his career, has become more than any other incident the starting-point of modern history—his tomb, as Lamartine put it, was the grave of the old world and the cradle of the new. But that memorable transaction was the execution of a capital sentence, proceeding upon a two-fold criminal trial—upon one process conducted according to Hebrew and one according to Roman law.

In its judicial aspect, as in some others, it is peculiar — perhaps unique. There have been many judicial tragedies recorded in history. Capital trials, like those of Socrates, of King Charles of England, and of Mary of Scotland, have always had a fascination for men. And this trial has impressed and attracted the world more than any or all of these. But I wish to point out that it has in addition a purely legal interest which no one of them possesses. By common consent of lawyers, the most august of all jurisprudences is that of ancient Rome. But perhaps the most peculiar of all jurisprudences, and in the eyes of Christendom the most venerable as well as peculiar, is that of the Jewish commonwealth. Now, when these two famous and diverse systems happen for one moment to meet, the investigation of the transaction from a legal point of view is necessarily interesting. And, when the two systems meet in the most striking and influential event that has ever happened, its investigation becomes not only interesting but important. It becomes, probably, the most interesting isolated problem which historical jurisprudence can present.

The questions, for example, are at once raised: "Were there two trials or only one? Was the second a mere review of the first, or was the first a mere preliminary to the second? Were the forms, in the one case of Hebrew, in the other of Roman, law, observed, or attempted to be observed? And was there in either case an attempt, with or without form, to attain substantial justice? Again, were the charges preferred before the Hebrew and Roman tribunals the same? What was the crime for which the accused died? Was the decision in either case right in form, and attained by steps in conformity with the process binding or observed at the time? And was it right in substance—i. e., was it in conformity with the Hebrew law, or the Roman law, as those laws then stood?

These questions of law proceed of course upon an assumed history of fact. The history is abundantly familiar; and, fortunately, there is no special necessity that we should commence this inquiry by an examination of the sources. Men are not agreed how far back they can exactly trace the three earlier gospels on the one hand, or the later gospel of John on the other. But the detail, verisimilitude, and authoritative calm of these documents impress the reader with a sense of the closest proximity to the life whose course is narrated. And they have no competitors. A few words in Tacitus, a disputed sentence or two in Josephus, occasional execrations scattered throughout the Talmud — these, and such as these, are the outside references to a career which burned itself in detail into the hearts of a generation of surviving disciples, and thence into the imagination of the world; and which, no doubt generally represented in these records as it was originally conceived, is there represented with extraordinary life-likeness and passive power. To some readers it will appear a singular advantage that in the documents on this special subject there is no reference to miracle. In none of the four records of the trial is there

(after the first arrest) any touch of the supernatural in *that* sense of the word. The whole narrative of external fact might have been told of any morning's work of the Sanhedrim, of any forenoon condemnation by the procurator. We may not, indeed, stretch this too far. The judicial narrative, unbroken by actual portent or marvel, maintains in each gospel the same tone of supernatural consciousness which in previous pages, apparently without surprise, or break, or sense of effort, passes into actual external miracle. Yet it remains true that, in the fragment of fourfold history with which we at present deal, there is nothing which the most determined enemy of the supernatural needs as such to regard even with suspicion. In truth, the incidents of the trial are most natural and probable, and, in so far as the four traditions agree, there seems no excuse for doubting the history. Of course, the four do not agree minutely here any more than in other parts of the narrative. The verbal variations of utterances reported in the gospels warn us to expect similar variations in the narration of facts. And, accordingly, we find such variations in the present case; some of them more than usually puzzling, and perhaps incapable of reconciliation. Yet, as we shall see, they do not seriously vary the legal problem; and the fourfold independence of the narratives by no means tends to make us doubt the truth of the history which they contain. Indeed, we may at once confess that the basis of fact on which we are to discuss the legal question before us is exceptionally clear, simple, and satisfactory. The sources of the law, on the other hand, may in each case require some preliminary remarks.

I.—THE HEBREW TRIAL.

All readers know that the Hebrew commonwealth, and the institutions which regulated it, were pervaded by a deep sentiment of justice, righteousness, and law. But all are not aware of the extent to which that sentiment, and its characteristic maxim, "Thou shalt do no unrighteousness in judgment," were developed in the later history of the people. In the more ancient part of the traditions of the Fathers we read: "When a judge decides not according to truth, he makes the majesty of God to depart from Israel. But if he judges according to truth, were it only for one hour, it is as if he established the whole world, for it is in judgment that the divine presence in Israel has its habitation." It has recently been pointed out to English readers, that that whole vast later literature of the Jews which we call the Talmud is "emphatically a *Corpus Juris*—a cyclopædia of all law," which may best be judged by analogy and comparison with other legal codes, more especially with that of Rome and its commentaries. It contains many other things, but this is its basis. And what is more important for us to notice is, that this legal basis is the older part. The whole Talmud consists of forty folios—a mass of discussion, illustration, and commentary. But the central part of it, which is comprised in twelve volumes, is called the Mishna. And the Mishna is nearly wholly law.[1] It was, indeed, of old, translated as the second or oral law—the δευτέρωσις—a detailed traditional commentary on the law of Moses, to which it professed complete subjection while practically superseding it as a code.[2] Mr. Deutsch, in striving to give English readers an idea of the multiplicity and confusion of the Talmud, likens it to Hansard: "the Parliamentary discussions or episodes answering to the Gemara or general commentary, while the Bills or Acts are called the Mishna." The distinction of course is, that in Hansard the legislative acts are the result and termination of the discussions, while in the Talmud the Mishna or law is the older portion and the starting-point. Accordingly, while portions of the general Talmud commentary did not come into existence for centuries after the introduction of Christianity, the Mishna or central portion is generally admitted to have been compiled by Rabbi Judah, somewhere about A. D. 200. But it was compiled as an oral law which had been growing in use and authority ever since the return of the nation from Babylon—as a "brief abstract of about eight hundred years' legal production." Hence, modern Jewish writers refer to it without hesitation as including the code of criminal law which was in existence at the date of the high-priesthship of Annas and Caiaphas. Of course this cannot be matter of demonstration in the case

[1] The quotations in this paper are made from the edition of the Mishna by Surenhusius (Amsterdam, 1672); and especially from the chapter or tractate "De Synedriis," in the fourth of its twelve volumes. I accept the Latin translation of the editor, and have only occasionally verified a word of the original.

[2] The Mishna (De Synedriis, x., 3) lays down the general principle, "Gravius peccatur circa verba scribarum quam verba legis." As an enthusiastic and recent translator paraphrases it, "He who teaches against the Pentateuch is not condemned to death, for all men know the Bible. But if he teaches against the doctors he is condemned."—*Rabbinowicz, Législation criminelle du Talmud.* Paris.

of all portions of a book which was not finally reduced to writing until two centuries had passed. But the evidence shows that the development of the Mishna in this special direction was exceptionally early and strong. Its earliest period coincided with the time of "the Men of the Great Synagogue," stretching from the return from the captivity to about B. C. 220. Their work has been summed up in the leading aphorism of the "Pirké Avoth," which runs, "Be cautious and slow in judgment, send forth many disciples, and make a fence round the law." [1] And this age, which inculcated caution in judicial action before all other things, was succeeded by the so-called age of "the Sanhedrim," which for the next four hundred years worked out that caution in detail. In nothing is the Mishna more express that in the contrast recognized at this early time between civil and criminal proceedings—judgments "of money" and judgments "of the life." Even with regard to the former, their rules strike the modern legal mind as leaning to the side of pedantic caution. But with regard to criminal, and especially to capital cases, there can be no doubt that long before the time of Jesus the value set by the law upon the life of a Hebrew citizen had led to extraordinary precautions. What have been called the four great rules of their criminal jurisprudence—"strictness in the accusation, publicity in the discussion, full freedom granted to the accused, and assurance against all dangers or errors of testimony" [2]—are carried out even in the Mishna in minute and scrupulous rules, leaning almost ostentatiously in every point to the side of the accused, and having force most of all in the case of a trial for life. Indeed, so far does this go, that modern Jews have been disposed to represent capital punishment as abhorrent to the whole genius of Hebrew jurisprudence. We read in the oral law the saying of Eleazar the son of Azarias, that "the Sanhedrim, which so often as once in seven years condemns a man to death, is a slaughter-house." [3] And more startling still, when we remember the Hebrew dread of all anthropomorphism in speaking of the Divine, is that terrible sentence of Rabbi Meir: "What doth God say (if one may speak of God after the manner of men) when a malefactor suffers the anguish due to his crime. He says, *My head and my limbs are pained.* And if he so speaks of the suffering of the guilty, what must he utter when the righteous is condemned?" [1] And so, to save the innocent blood, to hedge round and shelter the sacred house of life, rule after rule was laid down in successive lines of circumvallation, and presumptions in favor of the accused were accumulated, until a false conviction became almost impossible.

The question whether the Hebrew trial was according to their own rules of law has perhaps not been exhaustively considered by any one writer, though it has been touched upon by many. The most celebrated discussion upon it was raised by a learned Spanish Jew, M. Salvador, who in 1822, in the first edition of a work since twice republished under the title of "Histoire des Institutions de Moïse," [2] gave two excellent chapters on the penal law of the later Jews and on their administration of justice, and followed them up by a dissertation to show that the *Jugement de Jésus* was according to law. He admitted the facts as stated in the gospels, and founded on the law as stated in the Mishna; and from these sources professed to prove that, while the result may have been unfortunate if Jesus was really the Messiah, the process followed and the result arrived at were alike necessary, if the tribunal adhered to its own law. Salvador was answered in a brilliant treatise by a distinguished member of the French bar, M. Dupin (*aîné*). He, however (like an able American writer, Mr. Greenleaf), devoted himself rather to the substantial injustice of the trial than to its form according to the jurisprudence concerned; and in the third edition of his "Institutions," published in 1862, Salvador maintains and reprints the whole positions originally laid down. His argument falls short, however, on the most essential points so obviously that it cannot be made the basis of discussion. I propose, therefore, to treat the question anew, going directly to the sources of fact and law, and referring occasionally to Salvador as to other writers.

On a Thursday night in that month of March, the Thursday toward the end of the passover week, unquestionably took place the *arrest*—the first step before most modern trials. The question has been raised whether the arrest was legal. There is no reason to doubt that it was by au-

[1] Mishna, "Capita Patrum," i., 1. The same precedence is observed in the chief saying of their great representative, Simon the Just—"On three things stands the world—*on law*, on worship, and on charity."—*Cap. Patrum*, i., 2.

[2] Salvador, "Inst. de Moïse," i., 365.

[3] Mishna, "Treatise Makhoth."

[1] Mishna, "De Synedriis," vi., 5.

[2] The third edition, in two volumes (Michel Lévy Frères, Paris), is that here quoted.

thority of the high-priest; and the addition of a Roman *speira* to the officers of the Temple must have been procured by Jewish authority, and thus tends rather to favor legality. But was arrest before trial at all lawful by Jewish law? It seems not to have been so unless resistance or escape was apprehended. In this case no escape was intended, but resistance, though not intended, was looked for; and the lawfulness of the arrest really turns on the question whether it was to be the preface to a regular trial or not. If so, the legal course after it was that followed a little later by the captors of Peter and John, who "put them in ward until the next day, because it was now eventide." It was to be otherwise here.

An *examination* by night followed the arrest. Jesus was first led by his armed escort to the presence of Annas, by far the most influential member of the Sanhedrim. For in that body there now sat no less than five of his sons, all of whom either had held, or were in a few years to hold, the supreme dignity of high-priest. The old man had exercised that great office twenty years before, and had, perhaps, in the absence of the Roman governor,[1] stretched his powers, as his son afterward did, to the extent of carrying out capital sentences. At all events, the indignant procurator insisted on his removal from office; but, though Annas gave a formal consent, he merely transferred the chair of the great council to the younger members of his family.[2] It was now held by his energetic son-in-law Caiaphas, the aged head of the house remaining, in the estimation of orthodox Jews, the *de jure* high-priest. By Annas Jesus was sent bound to Caiaphas, perhaps only to another department of the sacerdotal palace. But before one or other of these princes of the church the accused was certainly subjected to a preliminary investigation before any witnesses were called. It is extremely difficult to decide whether this examination by "the high-priest," recorded by John alone, was made by Annas or by Caiaphas[3]—so difficult, that it is fortunate that scarcely any legal question turns upon the point.[4] The chief result of our decision of it is, that, if the examination detailed by John took place before Annas, it was separated by an interval of place, and also of time, from the subsequent proceedings before Caiaphas. In that case it is more probable that the examination of witnesses, the confession, and condemnation, which took place before the younger and titular high-priest, were somewhat later in the night, or even toward morning, and followed the form and order of a regular public trial. If, on the other hand, Annas at once sent on the prisoner to Caiaphas, and if the examination recorded was by the latter, it may have been immediately followed by the production of witnesses, and by the adjuration and condemnation; and in this case it is likely that a considerable interval succeeded these proceedings before a formal or public meeting of council in the morning confirmed the informal condemnation of the night. But the main point with regard to the high-priest's examination is independent of the question who the examiner was. It appears in any case to have been wholly illegal. In some countries—in France, for example, and in Scotland—the accused is led before a magistrate, and subjected to official interrogatories before he is remitted to his public trial. In others, and in the Hebrew law, it is not so. It was there the right of the accused to be free from all such personal investigation until he was brought for trial before his congregated brethren.[1] This rule of publicity seems to have been derived from principles both as to judges and witnesses. "Be not a sole judge," was one of the most famous aphorisms, "for there is no sole judge but One."[2] Still more clear was it, not from the Mishna only, but from the Pentateuch, that there was to be no such thing as a sole witness; and that the "two or three witnesses" at whose mouth every matter must be established must appear publicly to give their testimony.[3] Their deposition was the beginning of every proceeding; and, until it was publicly given against a man, he was held to be, in the judgment of law, not merely innocent, but scarcely accused. It is this principle which gives the fullest expla-

[1] Valerius Gratus, Pilate's predecessor. *See* Josephus, "Antiquities," xviii., 2, 1, and xx., 9, 1.

[2] "Like flies on a sore" was the comment of the Emperor Tiberius on the rapid succession in which one high-priest after another alighted upon Jerusalem during his reign.

[3] It depends partly on whether the word ἀπέστειλεν, in John xviii. 24, means "sent" or "had sent." *See* the full discussion of it in Andrews's "Life of Our Lord."

[4] Dupin objects that Annas was not a magistrate, and certainly that would add to the irregularity of interrogating the accused.

[1] "Un principe perpétuellement reproduit dans les écritures hébraïques, résume déjà les deux conditions de publicité et de liberté. On ne soumettait pas l'homme accusé à des interrogatoires occultes, où dans son trouble l'innocent peut fournir des armes mortels contre lui."—*Salvador's "Institutions,"* i., 366.

[2] Mishna, Pirké Avoth, iv., 8.

[3] Deuteronomy xix. 15–18.

nation of the answers of Jesus of Nazareth to the midnight questions of the high-priest. The ecclesiastical magistrate, probably sitting privately, and certainly before witnesses were called, asks Jesus of his disciples and of his doctrine.

"Jesus answered him, I spake openly to the world; I ever taught in the synagogue, and in the temple, whither the Jews always resort; and in secret have I said nothing.[1] *Why askest thou me? ask them which heard me*, what I have said unto them: behold, they know what I said."

It was in every word the voice of pure Hebrew justice, founding upon the broad principle of their judicial procedure, and recalling an unjust judge to the first duty of his great office. But, as one who studied that nation in older times observed, "When a vile man is exalted, the wicked walk on every side" around him; and when the accused had thus claimed his rights, one of the officers of court—a class usually specially alive to the observance of form, and of that alone—"struck Jesus with the palm of his hand, saying, Answerest thou the high-priest so?" The reply of Jesus is exceedingly striking. In it he again resolutely took his stand on the platform of the legal rights of a Hebrew—a ground from which he afterward no doubt rose to a higher, but which he certainly never abandoned: "If I have spoken evil, bear witness of the evil: but if well, why smitest thou me?"

The words are no doubt a protest for freedom of speech and liberty to the accused. But they appeal again to the same principle of the Hebrew law—that by which *witnesses* took upon themselves the whole burden and responsibility, and especially the whole initiative, of every accusation, even as they were obliged to appear at the close, and with their own hands to hurl the stones. And the renewed protest was so far effectual. For now the witnesses came forward, or, at least, they were summoned to bear their testimony; and only when they came forward can a formal trial be said to have commenced.

But did all this not take place by night? And was a trial by night legal?

On the question of fact, it is well known that the four evangelists give a confused account of what took place. Matthew and Mark, omitting the seemingly private interrogation of which we have already spoken, distinctly narrate a double and very striking trial by night—first by witnesses, and then by an attempt to obtain a confession; but all before the high-priest, the scribes, and the elders, to whom Mark adds, "all the chief priests." Their narrative reads as if the first part of this trial might have taken place almost as soon as the prisoner was brought from the mount of Olives. At all events, in their narrative it took place by night, while in the morning there was a second and separate "consultation" of a similar but seemingly larger and more authoritative meeting.[1] John, on the other hand, narrates the interrogation by the high-priest, the transfer from Annas to Caiaphas, and the delivery to Pilate in the morning, but does not allude to any trial before the council. These two representations, though not contradictory, are unsatisfactory and inconsistent; and the tradition of Luke, which differs from both, completes the confusion, but helps us to a result. He omits the earlier part of the alleged trial—the interrogation of witnesses; but narrates the confession and condemnation as at one meeting of the council, which took place "as soon as it was day," and after which the whole multitude "led him to Pilate." Putting all these representations together, there is no difficulty in arriving at the order of the historical transactions, though there will always be insuperable difficulty to those who insist on their legal validity and regularity. The visit to Annas and the transfer to Caiaphas came first, with the interrogation of the accused by one or other of the high-priests. About this earlier hour certainly took place the denial of Peter related by all the evangelists, while some time must have been consumed in sending for witnesses and summoning either the whole council or its members. That the whole council did not meet at night is unquestionable: that a certain number of them were present by night with Caiaphas is equally clear. Assuming that there was a final and formal meeting of the whole Sanhedrim at its usual morning hour, it is barely possible that the vivid scene of the adjuration, confession, and sentence, took place before it. But it is much more likely on the evi-

[1] These words recall a very curious provision of the Mishna (De Synedriis, vii., 10), as to the *Mesith*, or private "seductor—i. e., laicus seducens laicum"—a phrase which is, no doubt, translated in the gospel words "deceiver of the people." In the case of such a one, who says, privately, "Let us go after other gods," the rule as to laying no snares for the accused was superseded. The person attempted to be seduced might profess to acquiesce, and so hide other witnesses to overhear the *Mesith*, and testify against him.

[1] Bynæus (De Monte Christi) holds a second trial in the morning. But the view (recently repeated by Dr. Farrar), that Luke narrates a different scene from that given in nearly the same words by the early evangelists, is scarcely tenable.

dence that it took place earlier, when a considerable number, quite enough to be popularly called a council, were already assembled. And, in any case, it is certain that that still earlier transaction—the examination of witnesses and the deliberation on their evidence—must have taken place some time during the night. It will always remain doubtful whether this took place before a considerable meeting of the council or its committee on the one hand, or before Caiaphas and a few of his friends on the other. Nor is it of much consequence. The confusion of representation is quite natural. For, according to all the rules of Hebrew law, such a transaction in the night was absolutely illegal, incapable of being validly transacted in either form, and incapable of being reported so as to produce an impression of justice upon the minds of the people.

The law is laid down in a passage of the Mishna,[1] which contrasts capital trials with questions of money. It is so striking that the whole paragraph may be quoted, though it is with the concluding words that we have now to deal:

"Money trials and trials for life have the same rules of inquiry and investigation. But they differ in procedure, in the following points: The former require only three, the latter three-and-twenty judges. In the former it matters not on which side the judges speak who give the first opinions: in the latter, those who are in favor of acquittal must speak first. In the former, a majority of one is always enough: in the latter, a majority of one is enough to acquit, but it requires a majority of two to condemn. In the former a decision may be quashed on review (for error) no matter which way it has gone: in the latter a condemnation may be quashed, but not an acquittal. In the former disciples of the law present in the court may speak (as assessors) on either side: in the latter they may speak in favor of the accused, but not against him. In the former a judge who has indicated his opinion, no matter on which side, may change his mind: in the latter he who has given his voice for guilt may change his mind, but not he who has given his voice for acquittal. *The former (money trials) are commenced only in the daytime, but may be concluded after nightfall; the latter (capital trials) are commenced only in the daytime, and must also be concluded during the day. The former may be concluded by acquittal or condemnation on the day on which they have begun: the latter may be concluded on that day if there is a sentence of acquittal, but must be postponed to a second day if there is to be a condemnation. And for this reason capital trials are not held on the day before a Sabbath or a feast-day.*"

[1] Mishna, De Synedriis, iv., 1.

The crucifixion of Jesus took place, as has scarcely ever been doubted, on the Friday, the day before a Sabbath which was also "an high day;" and the meeting of the council took place on the same Friday morning.[1] Such a meeting on such a day was forbidden. If indeed it only met to register an acquittal, it was lawful. But if the court was unable at once to acquit, it was bound to adjourn for at least four-and-twenty hours before meeting for final judgment, and such a final meeting could not be on the Sabbath. The necessity of the adjournment of a capital trial to secure the rights of the accused is shown very clearly by the detailed regulations of the Mishna:[2]

"If a man is found innocent, the court absolves him. But if not, his judgment is put off to the following day. Meantime the judges meet together, and eating little meat, and drinking no wine during that whole day, they confer upon the cause.[3] On the following morning they return into court" and vote over again with the like precautions as before. . . . "If judgment is at last pronounced, they bring out the man sentenced, to stone him. The place of punishment is to be apart from the place of judgment (for it is said in Leviticus xxiv. 14, 'Bring the blasphemer without the camp'). In the mean time, an officer is to stand at the door of the court with a handkerchief in his hand; another, mounted on horseback, follows the procession so far, but halts at the farthest point where he can see the man with the handkerchief. [The judges remain sitting], and if any one offers himself to prove that the condemned man is innocent, he at the door waves the handkerchief, and the horseman instantly gallops after the condemned and recalls him for his defense.[4]

These regulations, taken not from the commentary on the oral law, but from the Mishna itself, probably existed in full detail during the high-priesthood of Caiaphas. There is no reason to doubt that at least the general rule, which prescribes adjourning the trial from one day to another, bound the judges of Jesus of Nazareth. In no case was such a rule so absolutely necessary to justice, as where the accused, arrested after nightfall, had been put upon his trial by day-

[1] We thus escape, in our present investigation, the extremely difficult and famous questions whether the Friday was the 14th or 15th Nisan, and on which day of that week the passover was eaten. If the Friday was the 15th, it was the passover or feast-day, when it seems to have been unlawful to judge at all.—*Mishna, Moed Katon*, v., 2.

[2] Mishna, De Synedriis, v., 5. and vi., 1.

[3] "Beatus judex qui *fermentat* judicium suum."—*Gemara on Mishna, De Synedriis*, c., 1.

[4] A striking commentary on this graphic law will occur to English readers who remember the interposition of Daniel in the "History of Susanna," verses 46 and 49.

break, without the least opportunity of summoning witnesses for his defense. But what the Gemara describes as the *atrocity* of thus anticipating the day of death of the accused [1] was exceeded in open injustice by the earlier outrage of commencing, and probably substantially concluding, the real trial under cloud of night. That would have been an intolerable scandal even in the case of an ordinary civil suit. Such a suit could only be called and commenced during the day, though upon occasion it might be prolonged after the shadows had fallen until a verdict were returned.[2] But a grave criminal case—and certainly a capital case of crime—was to be begun, and resumed or continued, and finished, only in the light of day. And of all criminal cases, that a trial in which a son of Israel, acknowledged to be mighty in deed and word before all the people, was to be judged for his life—that such a trial should be begun and finished and sentence formally pronounced, between midnight and morning, was a violence done to the forms and rules of Hebrew law as well as to the principles of justice. And the circumstance that this huge blot is wholly ignored by Salvador [3] makes it very unnecessary to notice in detail his defense of other parts of the supposed formal judicial proceeding.

Yet there can be no doubt that at some untimely hour, between Thursday night and Friday morning, the form and somewhat more than the form, of a trial by Hebrew law did take place. The judges, unjust as they were, were men trained in that law of minute scruples and mighty sanctions; and they would have felt it impossible to dispense with process and form altogether. The last words we caught from Jesus were his demand for open accusation and trial: "Why askest thou me? ask them which heard me." And we shall hear no further utterance until the close. For when this demand for public justice was met by a nocturnal trial, the accused declined to take part in it. Meantime much was going on. The members of the council present sought for witness against Jesus. Matthew says they sought for false witness. But even the former was a scandalous indecorum. Hebrew judges, as we have seen, were eminently counsel for the accused. And one of the strangest sights the world has ever seen must have been the adjuration or solemn address to the witnesses who came to speak against the life of Jesus, by the magistrate who had—no doubt with perfect sincerity—held it expedient that one man should die for the people. That form of adjuration or solemn appeal still exists in the body of the law.[1] It was the duty of the high-priest to pronounce it to each witness in a capital case, and so to put them on oath. Who can measure the effect of its utterance by the sacred judge of Israel upon men who, while the words were uttered, were forced to gaze into the face of him whose life it guarded?

"Forget not, O witness, that it is one thing to give evidence in a trial as to money, and another in a trial for life. In a money suit, if thy witness-bearing shall do wrong, money may repair that wrong. But in this trial for life, if thou sinnest, the blood of the accused, and the blood of his seed to the end of time, shall be imputed unto thee. . . . Therefore was Adam created one man and alone, to teach thee, that if any witness shall destroy one soul out of Israel, he is held by the Scripture to be as if he had destroyed the world; and he who saves one such soul to be as if he had saved the world. . . . For a man, from one signet-ring, may strike off many impressions, and all of them shall be exactly alike. But he, the King of the kings of kings, he the holy and the blessed, has struck off from his type of the first man the forms of all men that shall live; yet so that no one human being is wholly alike to any other. Wherefore let us think and believe that the whole world is created for a man (such as he whose life hangs on thy words)."

The Son of man whose life was surrounded by the law with this tremendous sanction stood silent before those witnesses; and, whatever was the reason, their testimony was found ineffectual. What was the Hebrew law of evidence? The Talmud divides all oral evidence into—

1. A vain testimony.
2. A standing testimony.
3. An adequate testimony; or (perhaps) the testimony of them that agree together.[2]

The evidence of the earlier witnesses who on that night were examined seems to have been set aside as belonging to the first class; for a "vain testimony" was not even accepted provisionally, or retained until afterward confirmed. A "standing

[1] "Proferre diem morti damnati nefas est."—Mishna De Synedriis, iv., 1. Note 8 by Cocceius.

[2] Even this is forbidden by another text in the treatise "Nidah," and the jurists have had to settle the question of their relative authority.

[3] He narrates the trial and condemnation as taking place before a full meeting of the Sanhedrim, and adds (vol. i., 391), "Le conseil se rassembla de nouveau dans la matinée du lendemain *ou du surlendemain*, comme la jurisprudence l'exigeait pour confirmer la sentence ou l'annuler." This is mere invention of the history.

[1] Mishna, De Synedriis, iv., 5. "Intro vocatis terrorem incutiunt testibus."—ii., 6.

[2] Ibid., v., 3, 4. And see Lightfoot's Hor. Heb., Mark xiv. 56.

testimony," on the other hand, was admitted in the mean time and provisionally, but not held valid until confirmed by others. To this intermediate rank attained the evidence of that witness who at length came forward to speak to the early utterance of Jesus about the destruction and rebuilding of the temple. And when following him another came, the question was at once raised whether the testimony of both did not amount to the third and complete order of evidence, known as "the testimony of them that agree together." "But neither so," says Mark, using the exact technical term, "neither so did their witness agree together."[1] This may undoubtedly have been a mere discrepancy in their narration of facts. That discrepancy cannot have been great, according to our modern ideas. For Mark gives the evidence of both in one indiscriminating sentence. And Matthew does the same in another sentence, slightly different. Neither of them makes any explicit distinction between what the two witnesses said. Let us suppose that the discrepancy between the two (alleged by Mark) amounted only to this, that the one said, in Matthew's phrase, "I am able to destroy the temple of God," and the other, "I *will* destroy this temple." It is by no means clear that even such a difference as this might not have been sufficient to nullify their testimony. For in a Hebrew criminal trial "the least discordance between the evidence of the witnesses was held to destroy its value;"[2] and this rule, like others, was pushed to that childish extreme which we now call Judaical. A mere verbal distinction may have sometimes been a fatal objection in the mind of even such a judge as Caiaphas. But the evidence of men who are not reported to have said anything extreme, but whom the evangelists, departing from their usual reserve, distinctly call "false witnesses,"[3] was probably reckless and inaccurate. And it is just possible that the variation between the reports of the two evangelists covers not a mere verbal distinction, but a substantial and serious difficulty, of great importance for the conduct of the case.

For at this point we are confronted by one of the most important questions in the whole inquiry: What was the crime for which Jesus was all this time being tried? What was the charge, what the indictment, upon which he stood before the council? Up to this point we have had no intimation on that subject. In modern times that would be an extraordinary state of matters. To try a man, especially for his life, without specifying beforehand the crime on which he is to be tried, is justly held to be an outrage. Some of the greatest events in English constitutional history turn on the illegality of "general warrants"—the illegality, that is, not of trying a man without specifying his crime—the most arbitrary of our kings did not venture to do that—but of even committing him for trial without specifying his accusation in the warrant of committal. But we must not judge Jewish law, or, indeed, early law of any nation, by our modern rules. Hebrew law, as we have seen, gave a peculiarly important position to the witnesses. I believe we shall not fully realize that position unless we remember that, at least in the earlier days of that law, the *evidence of the leading witnesses constituted the charge.* There was no other charge: no more formal indictment. Until they spoke, and spoke in the public assembly, the prisoner was scarcely an accused man. When they spoke, and the evidence of the two agreed together, it formed the legal charge, libel, or indictment, as well as the evidence for its truth. This, to us paradoxical but really simple and natural origin of a Hebrew criminal process, is nowhere better illustrated than in that ancient *cause célèbre* of Naboth the Jezreelite: "They proclaimed a fast, and set Naboth on high among the people. And there came in two men, children of Belial, and sat before him; and the men of Belial witnessed against him, even against Naboth, in the presence of the people, saying, Naboth did blaspheme God and the king. Then they carried him forth out of the city, and stoned him with stones that he died." The essential points of a Hebrew trial for life are here given with admirable terseness.[1] But in the case of Naboth the false witnesses suborned by the Sidonian queen are represented as using the technical word, or *nomen juris*, of blasphemy. In the trial of Jesus the only witnesses distinctly spoken to reported a particular utterance of the accused. What crime was this utterance intended by the accusers, or the judges, to infer? There are two distinct meanings which may have been *innuendoed.* According to one of them, the words, "I will destroy this temple that is made with hands, and within three days I will build another made

[1] Unless Mark, when he says their testimonies were οὐκ ἴσαι, means that they were not "adequate," rather than not "accordant."

[2] Salvador's "Institutions," i., 373.

[3] There were gradations among false witnesses as among true—especially as they were consciously or unconsciously false. *See* Lightfoot on the Talmudic and technical meaning of the word, Hor. Heb., Matthew xxvi., 60.

[1] *See* also Josephus's account of the trial of Zacharias the son of Baruch: "De Bello Judaico," iv., 5, 4.

without hands," may have been represented as the voice of one come to attack the existing institutions—to "destroy the law and the prophets." We have a most important commentary on this in the parallel accusation of Stephen a few months later: "We have heard him say, that this Jesus of Nazareth shall destroy this place, and shall *change the customs* which Moses delivered us." But, according to another view, the same reported utterance—especially in the modified form of Matthew, "I am *able* to destroy the temple of God"—may have been intended as a charge of arrogating superhuman power. So his original auditors felt it. "Forty-and-six years was this temple in building, and wilt thou rear it again in three days?" The two charges, it will be observed, though very distinct, are not inconsistent. May he not have been charged *both* with attempting to change the national institutions and with pretensions to miraculous power? The difficulty in this supposition is that we have been seeking in these charges for the *one* crime upon which Jesus was finally condemned. But, if we look more narrowly at the supposed difficulty, we may find what we have been seeking. Jesus was finally condemned for "blasphemy," because he made himself the Messiah and the Son of God, making thus higher personal claims than even the witnesses against him had suggested. That was the crime, therefore, toward which one of the intended accusations—that as to superhuman power—may be held to have pointed. But what of the other? The unexpected but satisfactory answer is, that it fell under precisely the same legal category, or *nomen juris*—that of blasphemy. This might be suggested to us by the witnesses against Stephen, who describe as "blasphemous words" the deliberate utterances of the deacon as to the passing away of the holy place and the law. But I believe that it will be found there is no Hebrew category of crime under which the attempt to supersede the old institutions could so naturally come as that denoted by the term blasphemy. The witnesses, therefore, may have had this somewhat in view from the beginning, as the judges almost certainly had; and it is not too soon to devote a few sentences to the question what so important a legal word means.

Blasphemy is not profanity—it is profanity which, as the name imports, *strikes*[1] directly against God.[1] This is the original sense of the word, and it is that to which we have returned in modern days. But throughout the countries of Europe, ruled by civil and canon law, blasphemy has long since taken on a secondary and constructive meaning. It stands in their law-books at the head of the enumeration of crimes as "treason against the Deity," taking precedence even of treason against the state. And this *crimen læsæ majestatis divinæ*, like the crime of treason against earthly rulers, has often, under the head of constructive treason, taken great and dangerous latitude.[1] Now, whether it is a necessary thing for ordinary nations and jurisprudences to have in their statute-book such a crime as treason against God at all, we need not inquire. One thing is certain: in the Hebrew commonwealth and under Hebrew law it was necessary. For that commonwealth was the one pure theocracy, and all its priests, prophets, judges, and kings, were the mere courtiers and ministers of the invisible King, whose word was Israel's constitution and law. In such a constitution blasphemy, or the verbal renunciation of God, was in the proper sense high-treason; and any attempt to subvert the great institutions of his government was constructive treason. Now, neither the crime of the "false prophet" of the true God, nor that of "the idolater" or seducer to the worship of strange gods, seems to have attained to the generality and eminence of the name of blasphemy in Jewish law. That the word was used in the age of Caiaphas to designate alleged attempts against the Divine system of religion is certain. That it had become the proper *nomen juris* for all such constructive treasons I have not seen conclusively proved; but it seems highly probable.

We cannot, therefore, hold, as has sometimes been done, that these witnesses brought forward a special and isolated charge with regard to the temple, and that on the failure of it the council passed unfairly to other and disconnected counts. The special charge was at least in the line of the whole procedure contemplated.[2] For, unless we are to become wholly unhistorical in our legal criticism, we must believe that the general course of this night's proceedings was prearranged by the leading members of the Sanhedrim, and that they and not the witnesses really conducted the prosecution. The evidence is overwhelming[3]

[1] The Hebrew words seem to carry the same implication of verbal offense and insult.

[1] The canon law definition of blasphemy puts its original meaning last, and puts first that it is ascribing to God "quod Illi non convenit."

[2] Exactly as the charge against Stephen was in the line of his subsequent and sudden condemnation.

[3] John vii. 25, 30, 45; viii. 40; ix. 22; xi. 47, 57. Matt. xxi. 23, 46. Luke xx. 20. Matt. xxvi. 3, *et seq.*

that at repeated meetings of what the fourth gospel even calls a council, and what may have been formal meetings of the acting committee of that body, the suppression, and if need be the death, of Jesus had been resolved upon. And in these preliminary proceedings it was not merely his acts as a prophet, or as an opposer of existing institutions, that were deliberated upon. His claim to be the Christ, and even (as his nearer followers had long ago acknowledged him to be) the Son of God—whatever that mysterious claim might mean—had during the second part of his career[1] pressed heavily upon the Hebrew conscience, especially in Jerusalem. The decision alleged in the fourth gospel, "That if any man did confess that he was the Christ, he should be put out of the synagogue," does not indeed negative that claim. It may only, as Neander holds, have reserved it for the judgment of the one competent tribunal, the great council of the nation; while it forbade all private persons, whatever their individual views, from in the mean time publicly anticipating the solemn verdict. But it combines with innumerable other parts of the history to show the agitating questions which pressed on the minds of the judges as they listened to witness after witness in that early dawn.

The evidence, all agree, was not found sufficient—perhaps not found "relevant"[2]—to infer a conviction upon it alone. The rule of law in such a case was clear, that the accused must be at once liberated. And, even had the inculpatory evidence been found sufficient, the next step by the rules of the court was to call witnesses for the defense.[3] Such a proposal would, of course, have been a mockery in a trial at such an hour. What was actually done was an attempt to cross-examine the accused. "Answerest thou nothing? What is it which these witness against thee?" are the exact words of the high-priest repeated in two of the narratives. But he "held his peace, and answered nothing." The interrogation was unlawful. But I am not able to represent this silence as caused by indignation at the errors of the accusers, or the unfairness of the judges. That the ordinary rights of every accused Hebrew had been present to the mind of Jesus we have already seen. But that he had any expectation of escaping, or even any desire at this stage to do so, there is no evidence whatever. All the narratives combine to show that he had for some time been consciously moving on to a tragical and tremendous close of his brief career. His utterances in anticipation of it during the previous weeks, and especially on the preceding day, have held the world spell-bound in each succeeding generation. A similar height of self-possession marks him at this final hour. The inaccurate or malicious recollections of what he had said three years before were nothing now to him. He had not come to Jerusalem to perish by a mistake; and, if we are to fill that silence with thoughts at all, we may suppose that they had reference to the scene that now surrounded him. For there, at last, were gathered before him the children of the house of Israel, represented in their supreme council and great assembly. To this people he had always held himself sent and commissioned. Now, at last they have met; and all the ages of Israel's past rise in the mind of him who stands to be judged —or to judge.

At what hour the great concluding scene, so vividly described by three of the evangelists, took place, it is impossible to say.[1] Plainly enough, the private and public examinations of the witnesses must have occupied a considerable time, and whether or not these had been attended by "all the council," or a portion of its members, it is quite certain that by this time—at the point where these examinations were discontinued—a large number of the "great Sanhedrim" was met. The members of that body numbered seventy-one; the "little Sanhedrim," which was probably a committee or cabinet formed out of the larger, numbered only twenty-three.[2] It is very possible that the smaller body may have been summoned at a somewhat earlier hour by Caiaphas, and it may be that no other ever assembled. Still the narratives rather suggest that the great council, which alone could at this time try a man for his life, and which alone could at any time judge a prophet,[3] was also called. Let us concede to the language of the evangelists that so much of the

[1] Too little studied of recent years—e. g., in both Renan and "Ecce Homo."

[2] Which of these is the meaning of the Hebrew word translated *ισῃ μαρτυρια*—an *even* testimony?

[3] There seems to have been no advocate for the defense, known as *Baal-rib*, or Dominus Litis.—Friedlieb, "Archæol." 87.

[1] "They say their phylacteries," says the Talmud Berachoth, i., 2), "from the first daylight to the third hour," at which last time the "lesser Sanhedrim" could meet, while the greater sat only "after the daily morning sacrifice."—*Maimonides on ch. De Synedriis*, iii. Luke seems to fix the first daylight as the time when they actually did "lead him into their council"—the arraignment.

[2] Mishna, De Synedriis, i. 6. The quorum of the Sanhedrim was twenty-three.

[3] "Tribus, pseudo-prophetes, sacerdos magnus, non

law was observed. We must, in that case, imagine the council as sitting in the hall Gazith, half within and half without the holy place.[1] The seats were placed in a circle, and half of the seventy sat on the right and half on the left of the president or *Nasi*, who, on this occasion, was the High-Priest Caiaphas. At his one hand sat the "father of the court," at the other the "sage." Two scribes waited at the table to record the sentence: two officers guarded the prisoner, who stood in front of the president. Among the semicircular crowd of judges, Caiaphas and his friends represented the great Sadducean element. The Sadducees, as rationalists, had no particular enmity to Jesus, over and above their general distaste for the introduction of the divine as an element in human affairs. But, as the aristocratic and official party, they were most keenly alive to the disorganization which that element often produces, and were always disposed to suppress it before it had got to a dangerous length. The previous appeal of the high-priest to the *salus populi* as overriding all individual claims of right—"Ye know nothing at all, nor consider that it is expedient for us that one man die for the people, and that the whole nation perish not"—was one full of reason. His plan seems to have been founded on a just and sound view of the temper of his own nation and of the Roman authorities, a clear-sighted and comprehensive view, omitting no element that ought to be taken into account, *except* the existence of God and his nearness to men. But in the working out of that plan a certain exasperation must by this time have mingled with the calm determination to get rid of a saintly fellow-citizen. The Pharisees, on the other hand, were an equally large part of the council, and their patriotic and religious feelings had originally been far more appealed to by the preaching of Jesus. But the inward struggle which had certainly preceded their rejection of his claims had caused that rejection to be followed, according to the ordinary laws of human nature, by a growing hostility, which by this time was a very active hatred. It was they, the zealots of the council, who, no doubt, took the initiative in the extraordinary and tumultuous scene which closed the sitting. During the later examination of witnesses Jesus had been silent; but the thought of his Messianic and divine claim pressed upon his judges with overwhelming force, and broke out at last into passionate utterance. The discrepancy between the evangelists at this point only brings out the whole scene more historically. "Art thou the Christ? tell us," they cried; and the irrepressible exclamations of the judicial crowd described in one gospel were only put an end to by the solemn adjuration of their president, recorded in another. To the eager and hostile questions of the council, Jesus answered at first in a twofold utterance: "If I tell you, ye will not believe." Was he thinking sadly of their forgotten duty to weigh his claims, and of a result to himself, or to them? But he adds: "And if I also ask you," as he had done a few days before in the temple, when they had demanded his authority, "if I, instead, put my questions to you, ye will not answer me, and ye will not release" your prisoner. It was true; but the council was long past being turned from its purpose by the reference which, I think, these words again have to judicial fairness and the order of justice. They saw in his face the light of that more than earthly claim which his lips only for a few moments delayed to make; and with a mixture of terrible and hateful emotions starting to their feet, "Then said they all, Art thou, then, the Son of God?" But above that crowd of aged and evil faces was now seen rising the High-Priest of Israel, and all voices sunk away as the chief magistrate and judge of the sacred nation demanded, in the name of the God whose office he bore, an answer to his most solemn adjuration, "I adjure thee by the living God, that thou tell us whether thou be the Christ, the Son of the Blessed!" It was the question for which men had waited so long; and now the answer came, "I am," the Christ, the Son of God: and, turning to the crowd who sat in their places of power around him, he added, "Hereafter shall *ye* see the Son of man sitting on the right hand of power, and coming in the clouds of heaven." When a king declared himself in Israel, the manner was that he stood in the temple by a pillar, and the people of the land receiving him rejoiced with hosanna and song, with palm-branch and with trumpet. And if this was the manner of a king, how should the King-Messiah be received? But when a man blasphemed the name of God, the ordinance in Israel was that every man who heard it should rend his garment from the top downward—rend it into two parts which might again never be sewed into one. And scarcely had Jesus witnessed his confession before those "many witnesses," when the high-priest, standing in his place, rent his clothes, saying: "He

nisi a septuaginta et unius judicum consessu judicantur."—*Mishna, De Synedriis*, i., 5.

[1] But see Lightfoot and others.

hath spoken blasphemy; what further need have we of witnesses? Behold, now ye have heard his blasphemy. What think ye?" And they answered and said, "He is Ish Maveth—a man of death." . . . "Then they all condemned him to be guilty of death."

So passed that great condemnation. There are very few points with regard to it which remain to be noticed. One relates to the lawfulness of the high-priest's adjuration, and to the judicial use of the confession of the accused.[1] Nothing can be clearer than the Talmudists on this. "Our law," says Maimonides, "condemns no one to death upon his own confession." "It is a fundamental principle with us," says Bartenora, "that no one can damage himself by what he says in judgment."[2] Putting the question to the accused was therefore the last violation of formal justice. Still, the question has been put, and the answer has been given. *Quid juris?* Assuming that the claim made by Jesus had come in the same form, but lawfully, before the Sanhedrim, were they shut up to this condemnation? In answering this we have first to remember the distinctions already taken between blasphemy, in its simple meaning of profanity or insult to God, and blasphemy as equivalent to treason, overt or constructive, against the theocracy. In the former sense there was no case here. The words of the great accused were full of filial reverence for the Father.[3] We have, therefore, to go on to the latter sense, and to face the grave question, Was it high treason in a Jew to claim to be the Messias, the Son of God? Most certainly it was—*unless it was true.* And if blasphemy was the proper word by which to designate so tremendously audacious a claim, then was such a false claim also blasphemous. But what if it were true? In such a case the falsehood was of the essence of the crime, and had to be proved or assumed before the judicial conclusion could be reached. The mere claim to be the Messiah was no crime. "Art thou the Christ?" was asked continually, of John, of Jesus, of every reformer, and of every prophet; though an answer in the affirmative was held to be the most daring claim that human lips could frame. What relation indeed the Messiah of the Jews was supposed to have to their unseen King, and how far the dignity, not unknown to that age, of "Son of God," could freely be applied to the expected Christ, are questions on which vast learning has been expended. We shall equally err if we suppose that these words had in their ears all the meaning with which subsequent theology has invested them, or if we forget that the purpose and bearing of the accused gave them, on this last as on previous occasions, a unique and divine significance. But the twofold claim—made seemingly in response to the grouping of the two ideas (Art thou "the Christ, the Son of God?") by the high-priest himself—could never release a Hebrew tribunal from the duty of weighing a claim to Messiahship. The proper response of an unbelieving judge, like Caiaphas, when his adjuration was answered by confession, was, "What sign shewest thou then, that we may see and believe thee?" And when instead he rent his clothes, with the words, "What need ye further witnesses?" it was either the preconcerted plan by which to terminate the whole semblance of judicial procedure, or, perhaps, a sudden inspiration of evil, spoken a second time not wholly of himself, in a moment when the cold, hard, cruel thoughts, which had so long smouldered in the unjust judge, blazed up at the touch of confronting righteousness into final and murderous paroxysm.

We pass next to the Roman tribunal. But our conclusion on the question of Hebrew law must be this: that a process begun, continued, and apparently finished, in the course of one night; with witnesses against the accused who were sought for by the judges, but whose evidence was not sustained even by them; commencing with interrogatories which Hebrew law does not sanction, and ending with a demand for confession which its doctors expressly forbid; all followed, twenty-four hours too soon, by a sentence which described a claim to be the fulfiller of the hopes of Israel as blasphemy—that such a process had neither the form nor the fairness of a judicial trial. But though it wanted judicial fairness and form, it may nevertheless have been a real and important transaction. There is no reason to think that the council mistook the claim of Jesus. And there is every reason to believe that their condemnation truly expressed the nation's rejection of his claim.—*Contemporary Review.*

[1] The adjuration was of course equivalent to putting the accused upon oath, and indeed seems to have been the usual way in which that was done. *See* Selden's chapter "De Juramentis" in his book on Sanhedrims, and the other treatises on the same subject in vol. xxvi. of Ugolinus's Thesaurus.

[2] Mishna, De Synedriis, vi., 2, note. So Cocceius: "Ita tenent Magistri, neminem ex propria confessione aut prophetæ vaticinio esse neci dandum." And even Salvador: "Notre loi ne condamne jamais sur le simple aveu de l'accusé."

[3] Of blasphemy in this proper sense, the cautious rule of the Mishna must be understood: "Nemo tenetur blasphemus, nisi expressit nomen."—*De Synedriis*, vii., 5.

VITAL FORCE.

THOUGH we have not the slightest conception of what life is in itself, and consequently could not define it, we may, for the sake of convenience, think of it in this paper as some kind of force.

"In the wonderful story," says Prof. Huxley, in his "Lay Sermons," "of the 'Peau de Chagrin,' the hero becomes possessed of a magical wild ass's skin, which yields him the means of gratifying all his wishes. But its surface represents the duration of the proprietor's life; and, for every satisfied desire, the skin shrinks in proportion to the intensity of fruition, until at length life and the last handbreadth of the *peau de chagrin* disappear with the gratification of a last wish. Protoplasm or the physical basis of life is a veritable *peau de chagrin*, and for every vital act it is somewhat the smaller. All work implies waste, and the work of life results, directly or indirectly, in the waste of protoplasm. Every word uttered by a speaker costs him some physical loss; and, in the strictest sense, he burns that others may have light—so much eloquence, so much of his body resolved into carbonic acid, water, and urea. It is clear that this process of expenditure cannot go on forever. But, happily, the protoplasmic *peau de chagrin* differs in its capacity of being repaired and brought back to its full size, after every exertion. For example, this present lecture is conceivably expressible by the number of grains of protoplasm and other bodily substance wasted in maintaining my vital process during its delivery. My *peau de chagrin* will be distinctly smaller at the end of the discourse than it was at the beginning. By-and-by I shall have recourse to the substance commonly called mutton, for the purpose of stretching it back to its original size."

This explanation may be very philosophical, but it is only a roundabout way of saying that, within reasonable bounds, we can recover the effects of exhaustion by proper food and rest; which, as a fact, people are pretty well acquainted with. The error to be avoided is, in any shape, to make such a pull on the constitution as to be beyond the reach of recovery. Life-force, or call it protoplasm, is an inherent quantity not to be heedlessly wasted; and this truth becomes more apparent the older we grow. Why is one man greater, in the sense of being more powerful than another? Because he knows how to get out of himself a greater amount of work with less waste of life-force.

We see from experience that the more men have to do the more they can do. And this paradox is only reasonable, for it is the necessity of great work that forces upon us systematic habits, and teaches us to economize the power that is in us. With the cares of an empire on their shoulders, prime-ministers can make time to write novels, Homeric studies, anti-papal pamphlets. It is the busy-idle man who never loses an opportunity of assuring you that "he has not a moment in the day to himself, and that really he has no time to look round him." Of course idle people have no time to spare, because they have never learned how to save the odd minutes of the day, and because their vital energy is expended in fuss rather than in work.

"He hath no leisure," says George Herbert, "who useth it not;" that is to say, he who does not save time for his work when he can is always in a hurry. One of the most sublime conceptions of the Deity we can form is, that He is never idle and never in a hurry.

The following words from a newspaper description of the sublime calmness of power manifested by the huge hydraulic crane used to lift Fraser's celebrated eighty-one ton gun, we take as our type of the powerful man who knows how to economize his vital force instead of wasting it by fussing: "Is there not something sublime in an hydraulic crane which lifts a Titanic engine of destruction weighing eighty-one tons to a considerable height above the pier, with as noiseless a calm and as much absence of apparent stress or strain as if it had been a boy-soldier's pop-gun? When we further read of the hydraulic monster holding up its terrible burden motionless in mid-air until it is photographed, and then lowering it gently and quietly on a sort of extemporized cradle without the least appearance of difficulty, one can readily understand that the mental impression produced on the bystanders must have been so solemn as to manifest itself in most eloquent silence." With the same freedom from excitement and difficulty does the strong man who saves his force for worthy objects raise up morally and physically depressed nations, take cities, or, what is harder to do still, rule his own spirit. It is the fashion nowadays to say that people are killed or turned into lunatics by over-

work, and no doubt there is much truth in the complaint. Nevertheless, it would seem that vital force is wasted almost as much by the idle man as by him who overworks himself, at high-pressure for the purpose of "getting on." It is indolence which exhausts, by allowing the entrance of fretful thoughts into the mind; not action, in which there is health and pleasure. We never knew a man without a profession who did not seem always to be busy. It may be he was occupied in worrying about the dinner or the place where he should spend his holiday—which he did not work for—in correcting his wife, in inventing pleasures, and abusing them when found, in turning the house upside down by doing little jobs foolishly supposed to be useful. And women, too, when stretched on the rack of a too-easy chair, are they not forced to confess that there is as much vital force required to enable them to endure the "pains and penalties of idleness," as would, if rightly directed, render them useful, and therefore happy? The fact is, there are far more who die of selfishness and idleness than of overwork, for where men break down by overwork it is generally from not taking care to order their lives and obey the physical laws of health.

Let us consider a few of the many ways in which we waste the stuff that life is made of. It has been well said that "the habit of looking on the bright side of things is worth far more than a thousand pounds a year;" and certainly it is a habit that must add many years to the lives of those who acquire it. Really every fit of despondency and every rage takes so much out of us that any one who indulges in either without a great struggle to prevent himself doing so should be characterized as little less than—to use an American expression—"a fearful fool." How silly it seems, even to ourselves, after cooling, to have acquired a nervous headache, and to have become generally done up, stamping round the room and showing other signs of foolish anger, because the dinner was five minutes late, or because some one's respect for us did not quite rise to the high standard measured by our egotism! As if it were not far more important that we should save our vital energy, and not get into a rage, than that the dinner should be served exactly to the moment.

One day a friend of Lord Palmerston asked him when he considered a man to be in the prime of life; his immediate reply was "seventy-nine. But," he added, with a playful smile, "as I have just entered into my eightieth year, perhaps I am myself a little past it!" How is it that such men work on vigorously to the end? Because they treasure their ever-diminishing vital force. They studiedly refrain from making a pull on the constitution. Reaching the borders of seventy years of age, they as good as say to themselves, "We must now take care what we are about." Of course, they make sacrifices, avoid a number of treacherous gayeties, and, living simply, they perhaps give some cause of offense, for the world does not approve of singularity. But let those laugh who win. They hold the censorious observations of critics in derision, and maintain the even tenor of their way. In other words, they conserve their vital force, and try to keep above-ground as long as possible. Blustering natures forgetful of the great truth that "power itself hath not one-half the might of gentleness," miss the ends for which they strive just because the force that is in them is not properly economized.

Then as regards temper: any man who allows that to master him wastes as much energy as would enable him to remove the cause of anger or overcome an opponent. The little boy of eight years old who, in the country, is often seen driving a team of four immense dray-horses, is one of the innumerable instances of the power of reason over mere brute-force, which should induce violent tempers to become calm from policy, if from no higher motive.

Many people squander their life's energy by not living enough in the present. They enjoy themselves badly and work badly, because they are either regretting mistakes committed in the past, or anticipating future sorrows. Now, certainly no waste of force is so foolish as this, because if our our mistakes are curable, the same energy would counteract their bad effects as we expend in regretting; and, if they are incurable, why think any more about them? None but a child cries over spilt milk. The mischief is done, and let it be forgotton, only taking care for the future. Sometimes people keep fretting about troubles that may never take place, and spend life's energy on absolutely nothing. Real worry from torturations of various sorts is quite enough, and causes a greater draught on our vital force than hard work. Let us not, therefore, aggravate matters by anticipations of troubles that are little better than visionary.

In looking ahead, it is of immense importance not to enter into any transaction in which there are wild risks of cruel disaster. There we touch on the grand worry of the age—a violent haste to get rich! Who shall say how much the un-

naturally rapid heart-beats with which rash speculators in shares in highly-varnished but extremely doubtful undertakings receive telegraphic messages of bad or good fortune must use up their life's force? Hearts beating themselves to death! Rushing to trains, jumping up-stairs, eating too fast, going to work before digestion has been completed—these are habits acquired naturally in days when it is the fashion to live at high-pressure; but such habits are surely not unavoidable, and would be avoided if we thoroughly valued our vital force.

There are persons of a nervous temperament who seem to be always upon wires. Nature has given them energy; but their physique is in many cases inadequate to supply the demands made upon it. The steam is there, but the boiler is too weak. Duke d'Alva, according to Fuller, must have been of this nature. "He was one of a lean body and visage, as if his eager soul, biting for anger at the clog of his body, desired to fret a passage through it." The same thought was wittily expressed by Sydney Smith, when he exclaimed: "Why, look there, at Jeffrey; and there is my little friend ——, who has not body enough to cover his mind decently with; his intellect is improperly exposed." Now, these are just the sort of people who should not kill themselves, for, though wrapped in small parcels, they are good goods. They owe it as a duty to themselves and others not to allow their fiery souls "to fret their pygmy bodies to decay"—not to throw too much zeal into trifles, in order that they may have a supply of life-force for things important. He who desires to wear well must take for his motto "Nothing in excess." Such a one, as we have had occasion more than once to urge, avoids dinners of many courses, goes to bed before twelve o'clock, and does not devote his energy to the endurance of overheated assemblies. When young men around him have got athletics on the brain, he keeps his head and health by exercising only moderately. He is not ambitious of being in another's place, but tries quietly to adorn his own. "Give me innocence; make others great!" When others are killing themselves to get money, and to get it quickly, that with it they may make a show, he prays the prayer of Agur, "Give me neither poverty nor riches," for he thinks more of the substance than of the shadow. This is the truly wise and successful man, and to him shall be given, by the divine laws of Nature, riches (that is, contentment) and honor (that is, self-respect), and a long life, because he did not waste the steam by which the machine was worked. In homely proverb, "he kept his breath to cool his porridge," and most probably was a disciple of Izaak Walton.

At this point, perhaps, the secret thoughts of some who have not yet learned how "it is altogether a serious matter to be alive," may take this shape: "What, after all," they may ask, "is the good of economizing life's force? Often I hardly know what to do with myself, nor have I much purpose in life beyond eating, drinking, and sleeping." To such thoughts we should give somewhat of the following answer: There is a work for every single person in the world, and his happiness as well as his duty lies in doing that work well. This is a consideration which should communicate a zest to our feelings about life. We should rejoice, as experience teaches us that each of us has the means of being useful, and thus of being happy. None is left out, however humble may be our position and limited our faculties, for we all can do our best; and though success may not be ours, it is enough if we have deserved it. Certainly, if there be any purpose in the universe, a day will come when we shall have to answer such questions as these: "You were given a certain amount of life-force; what have you done with it? Where are your works? Did you try to make the little corner in which you were placed happier and better than it was before you came into it?" It is said that Queen Elizabeth, when dying, exclaimed, "My kingdom for a moment!" and one day we shall all think nothing so valuable as the smallest amount of that force without which we cannot live.—*Chambers's Journal.*

PREDOMINANT DELUSIONS.

SEEING is believing! Such is an old saw, not usually called in question, and yet it is exceedingly fallacious. A great many phenomena seemingly true by the eyesight are not true at all. Ignorance and prejudice have led to very extraordinary mistakes. We speak of the sun rising and setting, because it appears to do so, but it neither sets nor rises. The earth turns in front of it like a roast turning before a fire. A conjurer will clearly show you that he will bring any number of eggs out of an empty hat. He only brings them out of his sleeve, where they were cunningly concealed. And so on with a great many other illusions, all seemingly fair and above-board, but in which we are imposed on either by our senses, or by some fallacy in reasoning. Less than two hundred years ago, courts of justice were hanging and burning thousands of old women for being witches—all on a sort of evidence which in the present day would only be laughed at. The world now knows better than believe such trash, but it took a long time to learn; and even yet this highly-experienced and much-complimented world occasionally falls into the most absurd crazes; or perhaps we should more correctly say, there are large numbers of tolerably educated but credulous people, who, with a taste for the wonderful, are ever ready to believe in any kind of nonsense that turns up. These worthy individuals are, of course, not without excuse. Starting with the principle that there may be forces in Nature which science has as yet failed to disclose, we should be cautious in asserting that any particular phenomenon that seems incomprehensible is a result of mere illusion or imposture. Let every mysterious demonstration, they say, be impartially inquired into. Quite correct. The misfortune, however, is, that before the matters in question have been examined impartially by the light of science, the craze gets ahead, and many persons, weakly allowing themselves to be carried away by their feelings, get painfully compromised, and are by the more cool and cautious part of mankind set down as little better than —fools. Very hard! But the warning offered is useful. If people of good standing will believe in absurdities without proper examination, they must take the consequences.

We have been led to make these remarks by a perusal of the lately-issued work, "Mesmerism, Spiritualism, etc., historically and scientifically considered," by Dr. W. B. Carpenter. In this ably-written and eminently readable small volume, the author brings to bear a long experience in scientific inquiry into the popular crazes and impostures of the last forty years, beginning with mesmerism and table-turning, and ending with spiritualism in the several shapes it has assumed. We commend the book to the serious consideration of the credulous. Tracing the history of marvels of different kinds, Dr. Carpenter states that the whole has been "a long succession of epidemic delusions, the form of which has changed from time to time, while their essential nature has remained the same throughout; and that the condition which underlies them all is *the subjection of the mind to a dominant idea.* There is a constitutional tendency in many minds to be seized by some strange notion, which takes entire possession of them; so that all the actions of the individual 'thus possessed' are results of its operation." Placed on this footing, the predominant delusion, be it a belief in witchcraft, mesmerism, or spiritualism, is a kind of monomaniacal frenzy. An absurd idea has got possession of the individual, and no reasoning with him to the contrary will have any effect in driving it out. He will absolutely get out of temper if his fanciful notions are so much as questioned. Usually the monomania spreads; and the more who suffer themselves to be affected the keener and more demonstrative does the delusion become. Certain frantic religious ferments in past and recent times have been due to nothing else than strange contagious influences, of which, after a time, when passion has subsided, all are pretty well ashamed, and fain to stifle out of disagreeable remembrance. We happen to have seen several of these prevalent crazes, droll in some respects, but very pitiable. After such mental disturbances, things, happily, shake themselves right at last, and all goes on as usual. The fever has subsided.

Often able and estimable men suffer themselves to be affected by the prevailing craze, and lead on others as imitators. It is now about forty years since, when, by invitation to a friend's house, we were present at an evening *séance*, in which an eminent professor at one of our universities entertained the company with what he confidently believed to be mesmeric experiments, such as sending persons to sleep, or rendering

them temporarily mute, by bidding them "tie their tongue." Here was a man skilled in a branch of physical science, but of eager temperament, and with a rage for novelty, lending himself indiscreetly to certain popular delusions which had originated in the crazed fancy of a charlatan. Mesmeric experiments of this sort were for a time a favorite amusement. They reminded us of the superstition in the old legends, in which "glamour" is said to have been cast over weak-minded individuals. This ancient glamour consisted in producing, by looks and gestures, a negation of self-assertion. The operator threw the patient into a kind of spellbound or dreamy condition without any power of correct reasoning. It was the conquest of the strong and resolute will over the weak and irresolute, through the effects of a kind of jugglery.

Mesmeric sleep, as it is called, is ordinarily produced by seemingly mystic passes of the hands, and an intense concentration of looks on the eyes of the person operated upon. In it there is nothing marvelous. Dr. Carpenter explains that it "corresponds precisely in character with what is known in medicine as 'hysteric coma;' the insensibility being as profound while it lasts as in the coma of narcotic poisoning, or pressure on the brain, but coming on and passing off with such suddenness as to show that it is dependent upon some transient condition of the sensorium, which, with our present knowledge, we can pretty certainly assign to a reduction in the supply of blood, caused by a sort of spasmodic contraction of the blood-vessels." This explanation, on a physiological basis, considerably reduces the mystic character of those mesmeric marvels in which the late Dr. Elliotson indulged at his public *séances* in Conduit Street. It does not, however, as we imagine, detract from the medical value that may be attached to the calming of the nervous system by what is spoken of as mesmeric sleep. Mr. Braid, a practising surgeon in Manchester, ingeniously fell on the device of producing a profound mesmeric slumber by simply causing individuals to fix their gaze determinedly at a cork stuck at the top of their nose. It was not surprising that people should have been lulled by being subjected to this species of hypnotism. Ordinary sleep may in most instances be induced by keeping the lower extremities perfectly still, and determinedly fixing attention on the act of breathing through the nostrils. Speaking from experience, we offer this as a hint to the habitually sleepless.

In the amusing book before us, the author shows how clairvoyants have imposed on public assemblies by tricks which could be seen through by skeptical observers. Miss Martineau, as is well known, had a profound belief in the marvels of mesmerism. This lady had a servant, J——, to whom were imputed wonderful powers of clairvoyance. On one occasion, while in the mesmeric sleep, she gave "the particulars of the wreck of a vessel, of which her cousin was one of the crew; as also of the previous loss of a boy overboard; with which particulars, it was positively affirmed by Miss Martineau, and believed by many on her authority, that the girl could not have been previously informed, as her aunt had only brought the account to the house when the *séance* was nearly terminated. On being asked, says Miss Martineau, two evenings afterward, when again in sleep, 'whether she knew what she related by hearing her aunt telling the people below,' J—— replied: 'No; I saw the place and the people themselves—like a vision.' And Miss Martineau believed her." After all, the girl was proved to be an impostor. A medical friend, on making a rigorous investigation, discovered "unequivocally that J——'s aunt had told the whole story to her sister, in whose house Miss Martineau was residing, about *three hours before the séance;* and that, though J—— was not then in the room, the circumstances were fully discussed in her presence before she was summoned to the mesmeric performance. Thus not only was J—— completely discredited as a seer, but the value of *all* testimony to such marvels was seriously lowered when so intelligent a witness as Harriet Martineau could be so completely led astray by her prepossessions as to put forth statements as facts, which were at once upset by the careful inquiry which she ought to have made before committing herself to them."

A preconceived determination or proneness to believe in the reality of any seeming marvel without any other evidence than the senses, goes a great way to explain the stories that are fondly cherished by the dupes of spiritualism. The error lies in taking things for granted. At one time people were all agog as to the wonders of table-turning, and it is amusing to remember how the wonder was speedily exploded by the appliances suggested by Faraday. He conclusively showed that the operators, however honest, unconsciously exerted a muscular action, causing the table to turn in the direction previously conceived. The whole thing was a curious piece of self-deception. Dupes of spiritualistic manipulators are similarly self-deceived. They go to *sé-*

ances in the fond hope of seeing incomprehensible marvels by "mediums" and table-rappers, and come away believing that all has been real, instead of being only tricks worthy or unworthy of a conjurer. Certainly, at no *séance* of spiritualists have the performances excelled the wonders effected by those adepts in conjuring, Maskelyne and Cooke.

Although exploded and discredited, table-turning has latterly come up in the new form of planchette, a fashionable toy alleged to be endowed with singularly mystic qualities. Consisting of a small and easily-moved board, in which a pencil is stuck with the point downward on paper or slate laid on a table, the machine is said to be capable of answering questions put to the operator who presses on the board with his hands. No doubt, the pencil will write answers as required, but it does so only by the conscious or unconscious muscular action of the hands on the board. This weak device of pretending to get answers to questions by the agency of an inanimate piece of wood and a pencil, has been resorted to by real or sham believers in spiritualism; and we are presented with the melancholy spectacle of decent-looking ladies and gentlemen sitting gravely round a table, affecting to hold a conversation with beings in the unseen world.

Just as mesmerism lost its reputation as a branch of psychology, so has spiritualism begun to be estimated at its true value. It was always very much against it, that its professors held their *séances* in darkened apartments, and that for the most part they took money for the display of their wonders. The thing became a trade, and so it would have continued but for the prosecution and conviction of persons who stood guilty of imposture, and of taking money under false pretenses. To add to the discomfiture of trading spiritualists, their tricks have been exposed in the book, "Lights and Shadows of Spiritualism," by D. D. Home, who, however, lets it be known that he is among the few genuine professors of the art whose operations are alleged to be beyond suspicion! As shown by Dr. Carpenter, deception is not confined to those who practise for gain. He speaks of young ladies who take pleasure in imposing on elderly persons by tricks of an ingenious kind. "I could tell," says he, "the particulars, in my possession, of the detection of the imposture practised by one of the most noteworthy of these lady-mediums, in the distribution of flowers which she averred to be brought in by the 'spirits' in a dark *séance*, fresh from the garden and wet with the dew of heaven; these flowers having really been previously collected in a basin up-stairs, and watered out of a decanter standing by—as was proved by the fact that an inquisitive skeptic having furtively introduced into the water of the decanter a small quantity of a nearly colorless salt (ferrocyanide of potassium), its presence in the dew of the flowers was afterward recognized by the appropriate chemical test (a per-salt of iron), which brought out 'Prussian-blue.'"

Other instances are presented of deceptions practised in private *séances;* but for these and much that illustrates the whole tenor of the delusion, we must refer to the work itself. We restrict ourselves to quoting only one, but a very pertinent remark: "It is affirmed, such exposures *prove* nothing against the genuineness of any new manifestation. But I affirm that to any one accustomed to weigh the value of evidence, the fact that the testimony in favor of a whole series of antecedent claims has been completely upset, seriously invalidates (as I have shown in regard to mesmeric *clairvoyance*) the trustworthiness of the testimony in favor of any new claimant to 'occult' powers. Why should I believe the testimony of any believer in the genuineness of D's performances, when he has been obliged to admit that he has been egregiously deceived in the cases of A, B, and C?"

For this instructive and admirably written work, offering a lucid philosophical explanation of the source of predominant delusions, which are apt to be turned to a bad account by the designing, and are in every sense mischievous, as conveying erroneous notions of natural phenomena, the learned author deserves the hearty thanks of the community.—*Chambers's Journal.*

CURIOSITIES OF THE VOICE.

SOME years ago, a delightfully interesting book was written by Sir Charles Bell on "The Human Hand." There might be fully as interesting a work written on the mechanism of the human voice, in which would be equally demonstrated the power, wisdom, and goodness of the Creator. We offer a few observations on the subject. Until recently there were mysteries difficult to explain concerning the wonderful inflections in the voice. Now, it is thoroughly understood how words are produced, and how the throat is able to send forth a wide variety of charming notes in singing. We begin by mentioning that Dr. Mandl has devoted himself to the study of the organs of speech, and from his work on "The Larynx" we give some interesting particulars. Investigators have long been occupied with researches; but, until they had seen the larynx of a living being, one thing only was proved—that the voice was formed in the glottis. For fifty years of this century they were trying by mirrors and other appliances to examine the interior of this organ, but without results. Suddenly an inspiration came into the head of a celebrated singer, whose name awakens charming remembrances among old amateurs. This was M. Manuel Garcia. Ignorant of all the trouble which surgeons had taken in order to observe the movements of the throat in the act of singing, he conceived the idea of looking at himself. By the help of two mirrors, the one reflecting the image on to the other, he saw the whole of his larynx depicted. In ecstasy before the glass, he determined to pursue the accidental discovery which had been so long dreamed of. But the autumn had set in, and the sun's rays, which were necessary to success, did not lend their aid. London with its fogs forced him to try artificial light, the results of which were unsuccessful, and therefore he could only profit by fine days; yet he soon recognized how isolated sounds were produced. In 1855 the Royal Society received some communications from him on these curious studies.

The subject was at once taken up with great activity, especially in Vienna, where success was far from equaling the hopes of the doctors. The caprices of solar light and the defects of artificial threw them into a state of despair. By all means they must improve their mirrors. Czermak, the Professor of Physiology at Pesth, taking an example from the instrument used in examining the eye, the ophthalmoscope, had recourse to a concave mirror which concentrated the light. From this time there was no difficulty but to perfect the lenses. Czermak, having acquired great skill in the use of his laryngoscope, visited the principal cities of Germany, where his demonstrations deeply interested surgeons and physiologists. He was warmly received in Paris in 1860, where he showed not only the whole length of his larynx, but also the interior of the trachea or windpipe as far as its bifurcation; a spectacle truly astonishing to those who witness it for the first time. It is not possible to examine the organ of the voice with the same facility in all; a man must have had some experience before he can do it.

A slight sketch of this organ will perhaps make the subject clearer. From the breast there rises to the middle of the neck the passage for the air between the lungs and the mouth; at one end it is divided into numerous branches, called the bronchial tubes; at the upper end, like the capital of a column, is seen the larynx, resembling an angular box; strong cartilages make it very resistent; and the interior is lined with a mucous membrane forming folds, named the vocal lips. These separate, lengthen, or shorten, in the formation of various sounds. The largest of the four cartilages rises in an annular form, and protects the whole structure. It is but slightly shown in the neck of the female, but strongly marked in the man, and is popularly called Adam's apple. Like everything else, the larynx presents individual differences: a fine development is an indication of a powerful voice; as the child grows up there is a sudden alteration and increase of size; but it always remains smaller in the woman than in the man; the angles are less sharp, the muscles weaker, the cartilages thinner and more supple, which accounts for the sharp, treble notes in their voices.

Singing demands a different kind of activity in the organs from speaking. In society, where education requires a submission to rule, singing belongs to the domain of art; but, in a primitive state, all nations have their songs. Musical rhythm drives away weariness, lessens fatigue, detaches the mind from the painful realities of life, and braces up the courage to meet danger. Soldiers march to their war-songs; the laborer rests, listening to a joyous carol. In the solitary chamber

the needle-woman accompanies her work with some love-ditty; and in divine worship the heart is raised above earthly things by the solemn chant.

A strong physical constitution, and a perfect regularity in the functions of the organs used in singing, are inappreciable advantages. They should be capable of rendering an inspiration short and easy, the expiration slow and prolonged; there is a struggle between retaining and releasing the air, and with the well-endowed *artiste* the larynx preserves its position, notwithstanding the great variety of sounds which it emits. But the evolutions of the parts are multiplied, the vocal lips vibrate, and the configuration of the cavity modifies the sounds which are formed in the glottis, and determine the tone of the voice. The most energetic efforts of the will cannot change this tone in any sensible manner. Professors injure their pupils by prescribing the position of the mouth, from which perhaps they themselves derive an advantage.

It is interesting to watch the play of the organs by the help of the laryngoscope, and see the changes which succeed one another in the low and high notes. At the moment when the sound issues, the glottis is exactly closed; then the orifice becomes a very long figure, pointed at the two extremities. As the sound rises, the vocal lips approach each other, and seem to divide the orifice into two parts; then as the highest notes are sounded, there is but a slit the width of a line. The vocal lips change like the glottis; they stretch out, harden, thicken, and vibrate more and more as the voice rises. Women, who have a smaller larynx, and shorter vocal lips, can sing higher notes than men, with a tone less powerful, but sweeter, more uniform, and melodious.

The ordinary limits of the voice comprehend about two octaves of the musical scale: it can easily be increased to two and a half; but some reach the very exceptional range of three, and three and a half. Thus, at the commencement of this century, Catalani astonished every one who heard her, as a sort of prodigy. Suppleness and intensity may be acquired by practice, as has been proved in the case of many singers: the voice of Marie Garcia was harsh, but it became at last the delicious one of Madame Malibran. In general, the natural gift is manifested without culture; the child endowed with this great charm warbles like a bird for amusement; a lover of art passes by, listens with surprise, and promises glory and fortune to the rival of the lark. Thus the famous Rubini won his triumphs. Occasionally the singer has in a moment lost all power, and an enchanting voice will disappear never to return; such a misfortune befell Cornelia Falcon.

Those who have watched the formation of vowels and consonants, can describe very precisely the positions which the lips, tongue, and palate, take in articulation. Yet almost identical sounds can be produced with different positions. As we all know, the teeth are a great help to pronunciation, but a person who has lost all his teeth can modify the play of the lips and tongue and express himself intelligibly. Actors imitate the voice of public characters so as to make the illusion complete. The ventriloquist can make his voice issue as if from a cavern. When misfortune has deprived a man of the whole or part of his tongue, he can still hold a conversation, though the sounds are never particularly agreeable. All this shows that there is nothing absolute in the actions which form words, though in general the same organs play similar parts. Those who were born deaf have ceased to be dumb by interpreting the movements of the mouth with wonderful certainty; they guess the words of the speaker instead of hearing them, and so learn to speak by imitation, their speaking, however, being seldom well modulated. There are now several institutions where the poor creatures who have been deprived of one of their senses can acquire a means of communicating with their companions without the tedious intervention of writing. The master indicates to the child how he must open his mouth, place his tongue and lips; he then draws the pupil's hand over his own larynx, so that he may feel the movement. Those who, like the writer, have seen this reading from the lips, will be struck with the surprising delicacy of the impressions made on the eye which has been thus cultivated.

In comparison with the human voice, that of animals seems poor indeed. The barking of the dog, the mewing of the cat, the bleating of sheep, cannot be called language, in the proper sense. Yet the larynx of these creatures is on the same plan as that of man. Among monkeys the resemblance is perfect. To all appearance the impossibility of speaking is due to the formation of the lips and tongue. In 1715 Leibnitz announced to the French Academy that he had met with a common peasant's dog that could repeat thirty words after its master. In spite of such an authority, we must always say when we most admire the intelligence of this faithful companion, "He only wants words." So well en-

dowed with memory, affection, and intelligence, he can only express his joy by sharp, short expirations of air through the glottis. Howling is a prolonged note in the pharynx, excited by deep grief or pain. Yet they in common with many other animals can communicate with each other in a marvelous manner when they wish to organize an expedition. A dead bullock was lying in a waste far from all habitations, when a solitary dog, attracted by the smell, came and fed upon it; immediately he returned to the village and called together his acquaintances. In less than an hour the bones were picked clean by the troop.

Opportunities for studying the language of wild animals are rare: they fly from man, and when in captivity they become nearly silent, only uttering a few cries or murmurs. Travelers have sometimes been able to watch the graceful movements of the smaller African apes. Living in the branches of trees, they descend with great prudence. An old male, who is the chief, climbs to the top and looks all around; if satisfied, he utters guttural sounds to tranquillize his band; but, if he perceive danger, there is a special cry, an advertisement which does not deceive, and immediately they all disperse. On one occasion a naturalist watched a solitary monkey as he discovered an orange-tree laden with fruit. Without returning, he uttered short cries; his companions understood the signal, and in a moment they were collected under the tree, only too happy to share its beautiful fruit. Some kinds possess a curious appendage, a sort of aërial pouch, which opens into the interior of the larynx and makes a tremendous sound. These howling apes, also called Stentors, inhabit the deepest forests of the New World; and their cries, according to Humboldt, may be heard at the distance of one or two miles.

If it be ever possible to observe the play of the larynx of animals during the emission of sounds, the subject will be a very curious one. The difficulty seems almost insurmountable, as their good-will must be enlisted; yet M. Mandl, full of confidence in his use of the laryngoscope, does not despair. After man, among animated Nature, the birds occupy the highest rank in Nature's concerts; they make the woods, the gardens, and the fields, resound with their merry warbles. Cuvier discovered the exact place from which their note issues. They possess a double larynx, the one creating the sounds, the other resounding them: naturalists call the apparatus a drum. Thus two lips form the vocal cords, which are stretched or relaxed by a very complicated action of the muscles. This accounts for the immense variety of sounds among birds, replying to the diversity in the structure of the larynx.

The greater number of small birds have cries of joy or fear, appeals for help, cries of war. All these explosions of voice borrow the sounds of vowels and consonants, and show how easy and natural is articulation among them. Those species which are distinguished as song-birds have a very complicated vocal apparatus. For the quality of tone, power, brilliancy, and sweetness, the nightingale stands unrivaled; yet it does not acquire this talent without long practice, the young ones being generally mediocre. The parrots which live in large numbers under the brightest suns, have a love for chattering which captivity does not lessen. Attentive to every voice and noise, they imitate them with extraordinary facility; and the phenomenon of their articulating words is still unexplained. It is supposed that there is a peculiar activity in the upper larynx. As a rule, they attach no meaning to what they say; but there are exceptions. When very intelligent and well instructed, these birds—such as Mr. Truefitt's late parrot, an account of which appeared in this *Journal* in 1874—can give a suitable answer to certain questions.

Our notes on this interesting study come to a close. Man is well served by his voice; words are the necessity of every-day life; singing is its pleasure and recreation, whether the performers are human beings or birds.—*Chambers's Journal.*

DEVELOPMENT OF THE FORMS OF ANIMAL LIFE.[1]

By Prof. ALLEN THOMSON, M. D., LL. D., F. R. S., F. R. S. E.

AFTER the long interval of six-and-thirty years the British Association for the Advancement of Science holds its annual meeting, the forty-seventh since its foundation, in this beautiful and interesting locality; and, strangely enough, on this occasion, as on the former, it passes from Glasgow to Plymouth. We are delighted to be assembled here, and are even surprised that the Association has been able so long to resist the power of attraction by which it has been gravitating toward this place. While we are prepared to be charmed by the surpassing beauty of its scenery, and know the deep interest of its prehistoric vestiges, its historic memories, and its artistic associations, we have been frequently reminded of its scientific vigilance by the records of its active scientific work; and we are now ready and anxious to witness all we can behold of its energy and success in the application of scientific discovery to the practical arts. Should we, as might be expected in a place hitherto so famous in its relations to our naval and military history, find most prominent those relating to the mechanism of war, we shall still hope that the effect of greater perfection in the engines of destruction may only be the means of rendering peace more permanent and secure.

It is a source of regret to myself, and may be, I fear, a cause of detriment to this meeting, that the choice of a president should have fallen upon one whose constant occupation with very special branches of science has fitted him so inadequately for the distinguished position to which he has been called. I can only derive comfort from knowing that, wherever it may be necessary, there are many others present most able to supply what may be wanting on my part; and I must, therefore, at once bespeak their assistance and your indulgence.

I have selected for the subject of the remarks which I am about to offer for your acceptance a biological topic, namely, the "Development of the Forms of Animal Life," with which my studies have been occupied, and which has important bearings on some of the more interesting biological questions now agitating the scientific world. But before proceeding with the discussion of my special subject, it is my desire to call your attention shortly to the remarkable change in the manner of viewing biological questions which has taken place in this country during the last half-century—a change so great, indeed, that it can scarcely be fully appreciated except by those who have lived through the period of its occurrence.

In the three earlier decades of this century it was the common belief, in this country at least, shared by men of science as well as by the larger body of persons who had given no special attention to the subject, that the various forms of plants and animals recognized by naturalists in their systematic arrangements of genera and species were permanently fixed and unalterable; that they were not subject to greater changes than might occur as occasional variations, and that such was the tendency to the maintenance of uniformity in their specific characters that, when varieties did arise, there was a natural disposition to the return, in the course of succeeding generations, to the fixed form and nature supposed to belong to the parental stock; and it was also a necessary part of this view of the permanency of species that each was considered to have been originally produced from an individual having the exact form which its descendants ever afterward retained. To this scientific dogma was further added the quasi-religious view that in the exercise of infinite wisdom and goodness, the Creator, when he called the successive species of plants and animals into existence, conferred upon each precisely the organization and the properties adapting it best for the kind of life for which it was designed in the general scheme of creation. This was the older doctrine of "Direct Creation," of "Teleological Relation," and of "Final Causes;" and those only who have known the firm hold which such views had over the public mind in past times can understand the almost unqualified approbation with which the reasoning on these questions in writings like the "Bridgewater Treatises" (not to mention older books on natural theology) was received in their time, as well as the very opposite feelings excited by every work which presented a different view of the plan of creation.

[1] Inaugural address of Prof. Thomson, as President of the British Association for the Advancement of Science, at its Plymouth meeting, delivered August 15, 1877.

On the Continent of Europe, it is true, some bold speculators, such as Goethe, Oken, Lamarck, and Geoffroy St.-Hilaire, had in the end of the last and commencement of this century broached the doctrine that there is in living beings a continuous series of gradations as well as a consistent and general plan of organization; and that the creation, therefore, or origin of the different forms of plants and animals must have been the result of a gradual process of development or of derivation one from another, the whole standing connected together in certain causal relations. But in Britain such views, though known and not altogether repulsive to a few, obtained little favor, and, by some strange process of reasoning, were looked upon by the great majority as little short of impious questionings of the supreme power of the Almighty.

How different is the position of matters in this respect in our day!—when the cautious naturalist receives and adopts with the greatest reserve the statement of fixed and permanent specific characters as belonging to the different forms of organized beings, and is fully persuaded of the constant tendency to variation which all species show even in the present condition of the earth, and of the still greater liability to change which must have existed in the earlier period of its formation—when the belief prevails that so far from being the direct product of distinct acts of creation, the various forms of plants and animals have been gradually evolved in a slow gradation of increasing complexity; and when it is recognized by a large majority of naturalists that the explanation of this wonderful relation of connection between previously-existing and later forms is to be found in the constant tendency to variation during development and growth, and the perpetuation of such variations by hereditary transmission through successive generations in the long but incalculable lapse of the earth's natural mutations. These, as you must all be aware, are in their essential features the views now known as Darwinism, which were first simultaneously brought forward by Wallace and Darwin in 1858, and which, after being more fully elaborated in the works of the latter and ably supported by the former, secured, in the incredibly short space of ten or twelve years, the general approval of a large portion of the scientific world. The change of opinion is, in fact, now such that there are few scientific works on natural history, whether of a special or more general character, in which the relation which the facts of science bear to the newer doctrines is not carefully pointed out; that, with the general public too, the words "Evolution" and "Development" have ceased to excite the feelings, amounting almost to horror, which they at first produced in the minds of those to whom they were equally unfamiliar and suspicious; and that even in popular literature and ephemeral effusions direct or metaphorical illustrations are drawn in such terms of the Darwinian theory as "struggle for existence," "natural selection," "survival of the fittest," "heredity," "atavism," and the like.

It cannot be doubted that in this country, as on the Continent, the influence of authority had much to do with the persistence of the older teleological views; and, as has been well remarked by Haeckel, one of the ablest and keenest supporters of the modern doctrine, the combined influence more especially of the opinions held by three of the greatest naturalists and biologists who have ever lived, viz., Linnæus, Haller, and Cuvier, men unsurpassed in the learning of their time, and the authors of important discoveries in a wide range of biological science, was decidedly adverse to the free current of speculative thought upon the more general doctrines of biology. And if it were warrantable to attribute so great a change of opinion as that to which I have adverted as occurring in my own time to the influence of any single intellect, it must be admitted that it is justly due to the vast range and accuracy of his knowledge of scientific facts, the quick appreciation of their mutual interdependence, and above all the unexampled clearness and candor in statement, of Charles Darwin.

But while we readily acknowledge the large share which Darwin has had in guiding scientific thought into the newer tracks of biological doctrine, we shall also be disposed to allow that the slow and difficult process of emancipation from the thralldom of dogmatic opinion in regard to a system of creation, and the adoption of large and independent views more consistent with observation, reason, philosophy, and religion, has only been possible under the effect of the general progress of scientific knowledge and the acquisition of sounder methods of applying its principles to the explanation of natural phenomena.

I have already referred to Goethe, Oken, Lamarck, and Geoffroy St.-Hilaire, as among the most prominent of the earlier pioneers in the modern or reformed conceptions of biological laws. But were it desirable to mark the progress of opinion by quoting other authors and laborers whose contributions have mainly supplied the materials out of which the new fabric has been

constructed, I should have to produce a long catalogue of distinguished names, among which would be found those of Lyell and Owen, as earliest shaping the doctrines and guiding opinion in this country; Johannes Müller and Von Baer, as taking the places of Haller and Cuvier on the Continent; and a host of other faithful workers in biology belonging to the earlier part of this century, such as those of G. Treviranus, J. F. Meckel, Carus, and many more.[1] To Huxley more especially, and to Herbert Spencer, the greatest influence on British thought in the same direction is to be ascribed.

Let us hope that in these times, when it has been found necessary to modify the older teleological views to so great an extent, although there may still be much that is unknown, and wide differences of opinion in regard to the nature and sequence of natural phenomena and the mode of their interpretation, all naturalists will now concur in one important principle, viz., that truthful observation and candid judgment must alone be our guides in the interpretation of Nature, and that that theory of creation is most deserving of our adoption which is most consistent with the whole body of facts carefully observed and compared.

To attempt to trace, within the limits to which my remarks must be confined, the influence which the progress of knowledge has exercised upon the scientific and general conception of biological doctrines would be impossible, for the modification of opinion on these subjects has proceeded not less from the rapid advance which our age has witnessed in the progress of general science, especially of physics and chemistry, than from that of departments belonging to biology itself.

Thus, to go no further than the most general laws of Nature, the whole doctrine of the conservation and transmutation of force in physics, so ably expounded to this Association by Mr. Justice Grove, the theory of compound radicals and substitution, with the discovery of organic synthesis, in chemistry, and the more recent advance in speculation with regard to the molecular constitution and properties of matter, with which we must associate the names of our last President and of Clerk Maxwell, in completely changing the aspect of physical and chemical sciences within the last thirty-five years, have paved the way for views of the constitution and action of organized bodies very different from those which could be formed at the time of the first meeting of the Association in this place. And if, confining ourselves to the department of biology, we add the discovery by microscopical observation of the minuter elementary forms of organization, more especially as flowing from the comprehensive views of organized structure promulgated by Schleiden and Schwann nearly forty years ago, the later discovery and investigation of living protoplasmic substances, the accumulated evidence of progressive types of animal and vegetable forms in the succession of superimposed strata composing the crust of the earth, the recent discoveries as to the conditions of life at great depths in the ocean, the vast body of knowledge brought together by the labors of anatomists and physiologists as to the structure and functions of almost every plant and animal, and (still more, perhaps, than any other single branch of biological inquiry) if we note the rapid and immense progress which has been made during the last fifty years in the study of the entirely modern science of the development of living beings—we shall be able to form some conception of the enormous extension in our time of the basis of observation and fact from which biological phenomena may now be surveyed, and from which just views may be formed as to their mutual relations and general nature.

It is now familiarly known that almost all (if not indeed all) the plants and animals existing on the earth's surface derive their origin from parents or previously-existing beings whose form and nature they closely reproduce in their life's history. By far the greater number spring from germs in the form of visible and known spores, seeds, or eggs. A few may be traced to germs, or to vestiges of the parental body, the exact nature of which may be doubtful; and some, including even a certain number of those also produced from known germs, are either constantly or occasionally multiplied by budding, or by a process of cleavage, or direct and visible division of the parent body.

The germ constituting the basis of new formation, whether it have the form of spore, seed, or ovum, is of the simplest kind of organization, and the process by which a new plant or animal is produced is necessarily one of gradual change and of advance from a simpler to a more complex form of structure: it is one of "evolution,"

[1] It would also be unjust to omit to mention here one of the earliest attempts to bring British opinion into a new channel, by the remarkable work entitled "Vestiges of Creation," which appeared in 1844, or to conceal from ourselves the unmerited ridicule and obloquy attempted to be thrown upon the author, not perhaps so much on account of the many inaccuracies unavoidable in an attempt at the time to overtake so large a field, as directed against the dangerous tendencies supposed to lurk in its reasoning.

or, as I would rather name it, "development." But before proceeding to discuss the subject of development in the higher animals, it is right to advert to the preliminary and often-debated question, which naturally presents itself, viz.: Do all living or organized beings, without exception, spring from germs, or from any kind of organized matter that has belonged to parents? or may there not be some, especially among the simpler forms (with regard indeed to which alone there has of late been any question), which are produced by the direct combination of their component elements, in the way of the so-called spontaneous or equivocal generation, heterogenesis or abiogenesis?

The importance of the right solution of this problem is not confined merely to the discovery of the mode of origin of the lowly organisms which have been the more immediate object of investigation by naturalists in recent times, but is one of much wider significance, seeing that, if it shall be satisfactorily proved or even rendered probable that in the course of cosmical development all the various kinds of plants and animals have been gradually produced by evolution out of preëxisting simpler forms, and thus the whole series of organized beings in Nature has been shown to be one of hereditary connection and derivation, then it would follow that the history of the origin of the simplest organisms may be the key to that of the first commencement of life upon the earth's surface, and the explanation of the relation in which the whole succeeding progenies stand to their parental stocks.

From the very lucid and masterly view of this subject given by Prof. Huxley in his address to the Association at Liverpool, so recently as in 1870, in which the conclusion he formed was based very much on the exhaustive and admirable researches of Pasteur, I might almost have dispensed with making further reference to it now, but for the very confident statements since made by the supporters of the doctrine of abiogenesis, among whom Dr. Bastian stands most prominent in this country, and for the circumstance that the life-history of many of the lower organisms was still imperfectly known.

During the last seven or eight years, however, renewed investigations by most competent inquirers have followed one another in quick succession, from a review of which we cannot but arrive at a conclusion adverse to the theory of heterogenesis, viz., that no development of organisms, even of the most simple kind, has been satisfactorily observed to occur in circumstances which entirely excluded the possibility of their being descended from germs, or equivalent formative particles, belonging to preëxisting bodies of a similar kind. I can do no more now than name the authors of the most conclusive experiments on this subject, which I do nearly in the order of the publication of their researches, as those of Mr. W. N. Hartley in 1872, Messrs. Pode and Ray Lankester in 1873, Dr. Burdon-Sanderson in that and the following years, Dr. W. Roberts in 1874, Prof. Lister in 1875, and most recently of Prof. Tyndall, Prof. Cohn, and of Messrs. Dallinger and Drysdale.[1]

But, admitting that the evidence from direct experiment is such as entirely to shut us out from entertaining the view that spontaneous generation occurs in the present condition of the earth, we are not relieved from the difficulty of explaining how living organisms or their germs first made their appearance; nor are we debarred from attempting to form hypotheses as to how this may have taken place. First, upon the theory of evolution, which, strictly carried out, supposes the more complex organisms to be derived from the more simple, it might be held that the conditions affecting the combination of the primary elements of matter into organic forms may at one time have been different from those which now prevail; and that, under those different conditions, abiogenesis may have been possible, and may have operated to lay the foundations of or-

[1] I may refer to Dr. Bastian's paper in *Nature* of June 30, 1870, and to his two works, "The Origin of the Lowest Organisms," and "The Beginnings of Life." Mr. Hartley's researches, which were commenced in 1865, are described in a paper printed in the "Proceedings" of the Royal Society for 1872, and in his "Lectures on Air," second edition, 1876, where an interesting account of the whole subject will be found. The experiments of Mr. Pode, of Oxford, and Prof. Ray Lankester, are described in a paper on the "Development of Bacteria in Organic Infusions" in the Royal Society "Proceedings" for 1873, p. 349. Dr. Burdon-Sanderson's researches are contained in the reports of the medical officer of the Privy Council, and in various papers in *Nature*. Dr W. Roberts's paper is printed in the "Transactions" of the Royal Society for 1874, vol. clxiv., p. 457. Prof. Lister's "Contribution to the Germ Theory of Putrefaction and other Fermentative Changes," etc., is contained in the "Transactions" of the Royal Society of Edinburgh for 1875, p. 313, and is also given in *Nature*. Prof. Tyndall's researches are described in his papers in the "Proceedings" of the Royal Society during the last two years. The work of Prof. Cohn, of Breslau, entitled "Beiträge zur Biologie der Pflanzen," 1873–'76, contains many memoirs bearing upon this subject, which have been partly published in abstract in the *Microscopical Journal*, in which also will be found, in a series of contributions extending from 1873 to the present time, the interesting observations of Mr. W. H. Dallinger and Dr. J. Drysdale.

ganic life in the simpler forms in which it at first appeared—a state of things which can only be vaguely surmised, but in regard to which no exact information can be obtained. Or, secondly, evading the difficulty of strict cosmical evolution, we might suppose that vital conditions may have been coeval with the first existence of physical and chemical properties in the rest of natural bodies. But this hypothesis would be exposed to the objection that, according to the cosmical view generally held by physicists, the whole materials composing the earth have originally been subject to incandescent heat. Nor is the difficulty abolished, but only removed to a more remote period, by the supposition of the transport of germs from another planet or their introduction by means of meteorites or meteoric dust; for, besides the objection arising from the circumstance that these bodies must have been subjected to a very high temperature, we should still have everything to learn as to the way in which the germs arose in the far-distant regions of space from which they have been conveyed.

The incompleteness of the geological record leaves us in the dark as to the time at which the first dawnings of life appeared in the lower strata of the earth's surface. The most recent researches tend to carry the origin of life back to a much earlier period than was at one time believed, and if the famous *Eozoön* be admitted as evidence, even into that of the Laurentian strata. But even if doubts should prevail with regard to the presence of definite organized forms in the older sedimentary strata, the occurrence in them of carbon in the form of graphite in large quantities makes the previous existence of living organisms at least possible, and it may be that the complete metamorphosis which these rocks have undergone has entirely removed all definite traces of organization.

Nor have we the means from geological data of determining whether the beings of the vegetable or of the animal kingdom first made their appearance. If we adopt the view which has for some time been entertained by physiologists that animals are entirely dependent, directly or indirectly, on plants for the material which constitutes their living substance, and that plants, as constructive agents, alone have the power to bring together the elements of lifeless matter from such states as carbonic acid, water, and ammonia, into the condition of the living solid, the inference would be inevitable, at least for the great majority of the animal creation, that they must have been preceded by plants. But palæontology is as yet silent on this interesting question; and, if we consider the remarkable approach which is made in structure and properties between the lowest and simplest members of the two kingdoms of organic Nature, so that at last all distinction between them seems entirely to vanish, and a set of organisms is found which partake equally of animal and vegetable characters, or, rather, exhibit properties which are common to them both, we shall hesitate to postulate confidently for the primitive antecedence of vegetable life, although, perhaps, in later epochs the preëxistence of vegetables may be looked upon as necessary to the life of more developed animal organisms.

The reflection forces itself upon us that we are just as ignorant of the mode of first origin of all the compounds of the inorganic elements as we are of that of living matter; and we may therefore be excused if we suspend all theory and conjecture until we shall be guided to more reliable hypotheses through the plain track of observation and experiment.

The practical applications of the increased knowledge of the origin of minute animal and vegetable organisms are so numerous that it would occupy a much longer time than is at my disposal to give any detailed account of them; but they are of such immense importance in their commercial, social, and sanitary relations, that they ought never to be lost sight of.

It is now proved beyond doubt that the origin of putrefaction and fermentation is dependent on the presence in the substances which are the seat of change in these processes, or in the surrounding air, of the germs of minute organisms of an animal or vegetable nature, and that the maintenance of the chemical changes in which these processes mainly consist is coincident with and casually (if not essentially) dependent upon the growth and multiplication of these organisms.

Prof. Lister had the merit of being the first to apply the germ-theory of putrefaction to explain the formation of putrid matters in the living body; and he has founded on this theory the now well-known antiseptic treatment of wounds, the importance of which it would be difficult to overestimate.

The success or failure of plans for the preservation of meat and other articles of food without question depends on the possibility of the complete exclusion of the germs which are the cause of putrefaction and fermentation; and their management must therefore be founded on the most accurate knowledge of these organisms, and

the circumstances influencing the persistence of their vitality and the vigor of their growth.

The theory of biogenesis has also lately been the guide in the investigation of the causes of various forms of disease, both in the lower animals and in man, with the result of showing that in many of them the infective substance consists in all probability of germs of minute animal or vegetable organisms.

There is very great probability, indeed, that all the zymotic diseases, by which we understand the various forms of fevers, have a similar origin. As has been well remarked by Baxter in an able paper on "The Action of Disinfectants," the analogies of action of contagia are similar to those of septic organisms, not to processes simply of oxidation or deoxidation. These organisms, studied in suitable fluids, multiply indefinitely when introduced in all but infinitesimal proportions. Thus they are, as near as we can perceive, the very essence of contagia.[1]

Leaving, however, these and many other general questions regarding the origin of the lowest forms of animal and vegetable life, let us now turn our attention to the mode of development of a new being in those belonging to the higher groups. The general nature of the formative process, in all instances where fertilized germs are produced, will be best understood by a short sketch of the phenomena ascertained to occur in different kinds of plants.

In the higher or phanerogamic plants it is generally well known that the combination of two parts of the flower is necessary to the production of a seed containing the embryo or young plant. Beginning with the discovery of the pollen-tubes by Amici in 1823, the careful and minute investigations of a long line of illustrious vegetable physiologists have brought to light the details of the process by which fertilization is effected, and have shown in fact how the minute tube developed from the inner membrane of the pollen-granule, as soon as it falls upon the stigmatic tissue of the seed-bearing plant, insinuates itself by a rapid process of development between the cells of the style, and reaches at last the ovule, in the interior of which is the embryo-sac; how, having passed into the micropyle, or orifice of the ovule, it makes its way to the embryo-sac; how a minute portion of the fertilizing substance of the fovilla transudes from the pollen-tube into the cavity of the embryo-sac, in which by this time a certain portion of the protoplasm has become differentiated into the germinal vesicle, thereby stimulating it to further growth and development, the earliest phenomena of which manifest themselves by the formation of an investing cell-wall, and by the occurrence of cell-division, which results in the formation of the embryo or plantule of the seed.

Thus it appears that the essential part of the process of production in phanerogamic plants is the formation in the parent plant of cells of two different kinds, which by themselves have little or no independent power of further growth, but which, by their union, give rise to a product in which the power of development is raised to the highest degree.

By further researches it is now known that the same law prevails in all the remaining members of the vegetable kingdom, with the exception only of the very simplest forms.[1]

In viewing the reproductive process in the series of cryptogamic plants, two facts at once strike us as remarkable in the modifications which are observed to accompany the formation of a productive germ, namely, first, that the difference between the two productive elements becomes, as it were, more prominent, or more highly specialized, in the cryptogamic than in the phanerogamic plants; and, second, that in the simpler and lower forms this difference gradually disappears till it is lost in complete uniformity of the productive elements.

Thus, in the whole tribe of the ferns and vascular cryptogams, in the higher algæ and fungi, in the characeæ and in the mosses, the differentiation of the productive elements is carried to a very high degree; for, while that belonging to the embryo or germ presents the structure of a simple cell which remains at rest, or in a comparatively passive state, and, absorbing into itself the substance of the other, becomes the seat of subsequent development the, other, corresponding to the pollen of the staminiferous phanerogam, is usually separated from the place of its formation, and, having undergone a peculiar modification of structure by which it acquires active moving cilia, it changes place, and is directed toward the germinal structure, and, coming in contact with its elementary cell, is more or less absorbed, or lost in the fertilizing process. The protoplasm of the germinal cell, thus acted

[1] For the most interesting information on this subject, I cannot do better than refer to the very able reports by Dr. Burdon-Sanderson in the "Reports of the Medical Officer of the Privy Council," 1873, 1874, and 1875.

[1] It will be observed that I leave entirely out of view the whole subject of the multiplication of plants by budding or simple division.

on and fertilized, then proceeds to undergo the changes of development by which the foundation is laid for the new plant.

In the algæ and fungi, however, there are gradations of the differentiation of the two reproductive cells, which are of the greatest interest in leading to a comprehension of the general nature of the formative process. For in the lower and simpler forms of these plants, such as the Desmidiæ, Mesocarpeæ, and other Conjugatæ, we find that there is no distinction in structure or form to be perceived between the two cells which unite or undergo conjugation; and a complete fusion or intermixture of the two masses of protoplasm results in the production of a single, usually spherical, mass holding the place of an embryo. And that there is an absence of specialization between the two uniting cells is clearly shown in both *Desmidium* and *Mesocarpus*, by the fact that the embryo or zygospore is formed in the mass resulting from the union of the protruded portions of the two cells; and in more ordinary cases, as in *Spirogyra*, where the embryo is formed in one of the two cells, it seems to be indifferent in which of them it is formed.

From this, which may be regarded as the most elementary type of new production by the union of the two cells, the transition is not a great one to the development of a progeny without any such union. We might conjecture, then, that the capacity for separate or individual existence extends in the lowest organisms to the whole, or to each structural element of their organization, while, as we rise in the scale of vegetable life (and the same view might apply to the animal kingdom), this capacity is more and more divided between the two productive elements, or, at least, is only called into full action by their combination.

The germinal element consists of a simple primordial cell, varying in different kinds of plants, but in all of them probably containing the essential substance protoplasm, and the most immediate result or effect of fertilization is the multiplication by repeated fissiparous division of the previously-existing cells. The new individual resulting from this cellular growth usually remains within the parent body, without, however, direct union or continuity of tissue, till the embryo has attained some advancement, as in the well-known case of the seeds of a phanerogam; but there are many varieties in the mode of its disposal among the lower plants.

A remarkable exception to the more direct relation of the process of fertilization to the formation of the new individual or embryo occurs in some plants, simulating in some respects that kind of variation in animal reproduction which has been named alternate generation. A well-known instance of this belongs to the vascular cryptogams. The prothallium of the ferns, for example, results from the development of so-called spores or unicellular buds, which are familiar as being formed in small capsules on the lower leaf-surface; and in this prothallium, when it has reached a certain stage of vegetation, there are formed the archegonia, containing the oöspheres, or germ-cells, which are fertilized by the moving ciliated particles developed in the cells of the antheridia, leading to the production of a new spore-bearing plant.

Recent researches have also called attention to the remarkable arrangements in phanerogamic plants for the prevention of fertilization of the pistils by pollen from the same flower, or even from the same plant. In the latter case this is effected by the separation of stamens and pistils in different flowers on the same or on different plants. In the former case, where both organs occur in the same flower, the adaptations, whether of a mechanical or of a physiological character, by which self-fertilization is prevented, as ascertained by numerous recent investigations (among which those of Darwin are most conspicuous), are of the most varied and often the most complicated kind.

Let us now turn to the consideration of the development of animals, and let me say in the outset that it will be necessary for me to confine my remarks chiefly to the higher or vertebrated animals, and to certain parts only of the history of their development; more particularly the structure and formation of the ovum or egg, its earlier developmental changes, and the relation of these to the formation of the new animal.

I cannot enter upon the consideration of this topic without adverting to the very recent acquisition of some of the most important facts upon which this branch of knowledge is founded; and I feel it to be peculiarly appropriate, in the year of his death, to refer to a biologist whose labors contributed more powerfully than those of any other person to give to animal embryology the character of a systematic branch of science, and to whom we owe some most important original discoveries—I mean Karl Ernst von Baer, of Königsberg, St. Petersburg, and Dorpat.

Of observers who, previous to Von Baer, were mainly instrumental in preparing the way for the creation of a more exact modern science of em-

bryology, only two can be mentioned, viz., Caspar Frederick Wolff, of St. Petersburg, well known as the author of a work entitled "Theoria Generationis," published in 1759, by which the *epigenesis*, or actual formation of the organs in a new being, was first demonstrated; and Christian Pander, who by his researches made at Würzburg explained, in a work published in 1817, the principal changes by which the embryo arises and is formed.

Von Baer was born in the Russian province of Esthonia, on February 29, 1792. After having been fifteen years professor in the Prussian University of Königsberg, he was called to St. Petersburg, and having some years later been appointed to a newly-established professorship of Comparative Anatomy and Physiology, he remained in that city for nearly thirty years as the most zealous and able promotor of scientific education and research, stimulating and guiding all around him by his unexampled activity, comprehensive and original views, sound judgment, and cordial coöperation. In 1868, at the age of seventy-six, he retired to Dorpat, from the university of which he had received his degree in 1814, and continued still to occupy himself with working and writing in his favorite subjects, as well as interesting himself in everything that was related to educational and scientific progress, to very near the time of his death, which occurred on November 28, 1876, in his eighty-fifth year.

Although Von Baer's researches, according to the light in which we may now view them, contributed in no small degree to the introduction of the newer views of the morphological relations of organic structure which have culminated in the theory of descent, yet he was unwilling to adopt the views of Darwin; and one of his latest writings, completed in the last year of his life, was in vigorous opposition to that doctrine.

It would have been most interesting and instructive to trace the history of the progress of discovery in embryology from the period of Von Baer down to the present time, but such a history would not be suitable to the purpose of this address; and I can only venture here, in addition to Rathke, the colleague of Baer in Königsberg, to select two names out of the long list of distinguished workers in this field during the last forty years, viz.: Thomas Bischoff, of Giessen and Munich, to whom we owe the greatest progress in the knowledge of the development of mammals, by his several memoirs, appearing from 1842 to 1854; and Robert Remak, of Berlin, whose researches on the development of birds and batrachia, appearing from 1850 to 1855, gave greatly-increased exactness and extension to the general study of development.

The germinal element, from which, when fertilized, the new animal is derived, is contained within the animal ovum or egg—a compact and definite mass of organic matter, in which, notwithstanding great apparent variations, there is maintained throughout all the members of the animal kingdom, excepting the protozoa, which are destitute of true ova, a greater uniformity in some respects than belongs to the germinal product of plants.

Usually more or less spherical in form, the animal ovum presents the essential characters of a "complete cell," in the signification given by Schwann to that term. The germinal substance is inclosed by an external vesicular membrane or *cell-wall*. Within this covering the *cell-substance*, generally named yolk or vitellus, from the analogy of the fowl's egg, consists, to a greater or less extent, of a mass of protoplasm, and imbedded in this mass, in a determinate situation, there is found a smaller internal vesicular body, the *germinal vesicle* or nucleus, with its more or less constant or variable *macula* or nucleolus.

Now, the first thing which strikes us as remarkable connected with the ovum is the very great variation in size as compared with the entire animal, while in all of them the same simple or elementary structure is maintained. The ovum of mammals is, for example, a comparatively small body, of which the average diameter is about the $\frac{1}{150}$ of an inch, and which consequently scarcely weighs more than a very minute fraction of a grain, which may be calculated perhaps only at the $\frac{1}{12000}$ part. And further, in two animals differing so widely in size as the elephant and the mouse, the weights of which may be held to stand toward each other in the proportion of 150,000 to one, there is scarcely any difference in the size of the mature ovum.

On the other hand, if we compare this small ovum of the mammal with the yolk of the egg in the common fowl, the part to which it most nearly corresponds, it may be estimated that the latter body would contain above 3,000,000 of the smaller ova of a mammal.

The attribute of size, however, in natural objects ceases to excite feelings of wonder or surprise as our knowledge of them increases, whether that be by familiar observation or by more scientific research. We need not, at all events, on account of the apparent minuteness of the ovum of the mammifer, or of any other animal, have

any doubts as to the presence of a sufficient amount of germinal substance for explaining in the most materialistic fashion the transmission of the organic and other properties and resemblances between the parent and offspring. For we are led to believe, by those who have recently given their attention to the size of molecules composing both living and dead matter, that in such a body as this minute ovum of the mammal there may be as many as five thousand billions of molecules, and even if we restrict ourselves to the smaller germinal vesicle, and, indeed, to the smallest germinal particle which might be made visible by the highest microscopic enlargement, there are still sufficient molecules for all the requirements of the most exacting material biologist.[1]

This great disparity of size is, however, connected with an important difference in the disposition of the yolk-substance, according to which ova may be distinguished as of two kinds—the large- and the small-yolked ova, between which there are also many intermediate gradations. The larger-yoked ova belong to the whole tribe of birds, scaly reptiles, osseous and cartilaginous fishes, and the cephalopods among the invertebrates; and are distinguished by the strictly germinal part or protoplasm being collected into a small disk, known familiarly as the cicatricula of the fowl's egg, and to be seen as a whitish spot on that side of the yolk which naturally floats uppermost; while the rest of the yolk, of a deeper-yellow color, contains a large quantity of vitelline granules or globules of a different chemical nature from the protoplasm.

The phenomena of embryonic development are, in the first instance at least, confined to the germinal disk, and the rest of the yolk serves in a secondary or more remote manner to furnish materials for nourishment of the embryo and its accessory parts. Thus we distinguish the germinal from the nutritive or food yolk, or, as the younger Van Beneden has named them, the *protoplasm* and the *deutoplasm*.

In the smaller ovum of the mammal, on the other hand, it seems as if the whole, or nearly the whole, of the yolk were protoplasmic or germinal. There may be some admixture of yolk-granules; but there is not the marked separation or limitation of the protoplasmic substance which is so distinct in birds, and the earliest changes of development extend to the whole component substance of the yolk, or, in other words, the yolk is entirely germinal. Hence some have given the names of *meroblastic* and *holoblastic*, meaning partially and entirely germinal, to these two contrasting forms of ova. There are many of the invertebrate animals of which the ova present the same entirely germinal arrangement as in those of mammals, and the *amphioxus* may be included in the same group.

The amphibia stand in some measure between the two extremes; the purely protoplasmic or germinal part occupying one side, and the nutritive or vitelline the other. But among the invertebrates the gradations are often such as to make it difficult to determine under which group the ova should be placed.

The genesis or formation of the ovum itself, if it be considered with reference to its first origin, carries us back to a very early period of the formation of the parent in which it is produced; and it is one of the most interesting problems to determine what is the source of the cells in the parent from which the ova originally spring. All that I can venture to say at present in regard to this point is, that the primordial ova or germs appear in the parental body while still embryonic, at a very early period of its development, and clearly derive their origin from a deeply-seated part of the formative cells which are undergoing transformation into the primitive organs; but the exact seat of the origin of the reproductive cells is still a matter of doubt.

When the ovum attains its full maturity in the ovary, the seat of its formation within the parent, it is separated from that organ, and when perfected proceeds to undergo embryonic development; a marked difference in this respect existing between the germinal product of the higher plants and animals.

The period of maturation of the ovum is marked in the greater number of animals by a series of phenomena which have generally been interpreted as the extrusion or absorption of the germinal vesicle; and various observers have actually traced the steps of the process by which that vesicle appears to leave the yolk and is lost to sight, or has passed into the space between the yolk and its membrane in the shape of the

[1] According to a calculation made by Mr. Sorby, the number of molecules in the germinal vesicle of the mammalian ovum is such that, if one molecule were to be lost in every second of time, the whole would not be exhausted in seventeen years. (*See* Address to the Microscopic Society in *Journal of Microscopical Science*, vol. xv., p. 225, and *Nature*, vol. xiii., p. 382. *See* also Darwin on Pangenesis, in his work on "Variations," etc. (1868), vol. ii., p. 374, and the review by Ray Lankester of Haeckel's work, "Perigenesis der Blastidule," etc., in *Nature* for 1876, p. 235, and Ray Lankester's essay on "Comparative Longevity," 1870.)

peculiar hyaline bodies named the *polar* or *directing* globules. But recent researches, afterward to be referred to, tend to show that some part, at least, of the substance of the germinal vesicle remains to form, when combined with the fertilizing element, the newly-endowed basis of future development.

Among the earliest changes to which the perfect animal ovum is subject, I have first to refer to the segmentation of the germ, a series of phenomena the observation of which has been productive of most important results in leading to a comprehension of the intimate nature of the formative process, and which is of the deepest interest both in a morphological and histological point of view. This process, which was first distinctly observed by Prevost and Dumas more than fifty years ago, and is now known to occur in all animal ova, consists essentially in the cleavage or splitting up of the protoplasmic substance of the yolk, by which it becomes rapidly subdivided into smaller and more numerous elements, so as at last to give rise to the production of an organized stratum of cells out of which by subsequent changes the embryo is formed.

The process of yolk-segmentation may at once be distinguished as of two kinds, according as it affects in the small-yolked ova the whole mass of the yolk simultaneously, or in the large-yolked ova is limited to only one part of it. The cleavage process, in fact, affects the germinal and not the food yolk; so that, to take the two most contrasting instances of the bird and mammal to which I have before referred, it appears that while the mammal's ovum undergoes entire segmentation, this process is confined to the substance of the cicatricula or germinal disk of the bird's egg. This process is essentially one of cell-division, but it is also in some measure one of cell-formation. The best idea of its nature will be obtained from a short description of the total segmentation occurring in the mammal's ovum.

When, as before mentioned, the germinal vesicle has been in part extruded or lost to sight, the whole yolk-substance of the ovum forms a nearly uniform mass of finely granular protoplasm, inclosed within the external cell-membrane. Within a few hours later a clear nucleus has arisen in this mass. To this more definite form of organization, assumed by the germinal substance of the future animal which is about to be the subject of the segmenting process, the name of the first segment-sphere may be given.

By the process of cleavage, which now begins, this first segment-sphere and its nucleus undergo division into two nucleated spheres of smaller size, the whole substance of the yolk, in a holoblastic ovum, such as that of the mammal, being involved in the segmenting process.

The second stage of division follows after the lapse of a few hours, and results in the formation of four nucleated segment-spheres; and the process of division being repeated in a certain definite order, there result in the succeeding stages, that is, the third, fourth, fifth, and up to the tenth, the numbers of 8, 12, 16, 24, 32, 48, 64, and 96 nucleated yolk-spheres, germ-spheres, or formative cells.

In the rabbit's ovum the tenth stage is reached in less than three days; and as during that time the size of the whole ovum has undergone very little increase, it follows that the spheres of each succeeding set, as they become more numerous, have diminished greatly in size. These segment-spheres are all destitute of external membrane, but are distinctly nucleated; and their protoplasmic substance is more or less granular, presenting the usual histological characters of growing cells.

By the time that segmentation has reached the seventh or eighth stage, when thirty-two or forty-eight spheres have been formed, the ovum has assumed the appearance of a mulberry, in which the outer smaller spheres, closely massed together, project slightly and uniformly over the whole surface; while the interior of the ball is filled with cells of a somewhat larger size and a more opaque granular aspect, also resulting from the process of segmentation.

Already, however, the mutual compression of the spheres or cells on the surface, by their crowding together, has led to the flattening of their adjacent sides; and by the time the tenth stage is reached, when the whole number of the cells is about ninety-six, the more advanced superficial cells, having ranged themselves closely together, form a neucleated cellular layer or covering of the yolk, inclosing within them the larger and more opaque cells, derived like the first from the segmenting process. In a more advanced stage, the deeper cells now referred to having also taken the form of a layer, there results at last the bilaminar blastoderm or embryonic germinal membrane.

The process of partial segmentation, such as occurs in the bird's egg, though perhaps fundamentally the same as that of the mammal previously described, stands in a different relation to the parts of the whole yolk or egg, and conse-

quently differs in its general phenomena. The segmentation is mainly restricted in the meroblastic ova of birds to the germinal disk or cicatricula, and does not immediately involve any part of the larger remainder of the yolk. This takes place during the time of the descent of the yolk through the oviduct, when the yolk is receiving the covering of the white or albumen, the membrane and the shell, previous to being laid—a progress which, in the common domestic fowl, usually occupies less than twenty-four hours. Corresponding essentially to the more complete segmentation of the mammal's ovum, the process leads to the same result in the production of two layers of nucleated formative cells in the original seat of a protoplasmic disk; a bilaminar blastoderm resulting as in the mammal's ovum, though in a somewhat different relation to the yolk.

I will not fatigue you with a description of the details of these phenomena, interesting as they may be, but only mention generally that they consist in the formation of deep fissures running from the surface into the substance of the germ-disk. The first of these fissures crosses the disk in a determinate direction, dividing it into two nearly equal semicircular parts. In the next stage another fissure, crossing the first nearly at right angles, produces four angular segments. Then come four intervening radial fissures, which subdivide the four segments into eight; and next afterward the central angles of these eight radial segments are cut off from their peripheral portions by a different fissure, which may be compared to one of the parallels of latitude on the globe near the pole where the radial or *longitude* fissures converge. And so thereafter, by the succession and alternation of radial and circular clefts, which, however, as they extend outward, come soon to lose their regularity, the whole germinal disk is divided into the two layers of nucleated cells, constituting the blastoderma or germinal membrane of Pander and all subsequent embryologists.[1] If a laid egg be subjected to the heat of incubation for eight or ten hours, the cicatricula, now converted into this segmented blastoderm, is found to be considerably expanded by a rapid multiplication of its constituent cells, and in as many more hours, by further changes in its substance, the first lineaments of the chick begin to make their appearance. Similar changes affect the blastoderm of the mammal, and thus it appears that the result of segmentation, in the bird as well as in the mammal and other animals, is the production of an organized laminar substratum, which is the seat of the subsequent embryonic development.

I must still request your attention to some details connected with the process of segmentation, which bear upon the question of the origin of the new cells, and on which recent research has thrown a new and unexpected light.

With respect to the nature of the first segment-sphere of the ovum, and the source of its nucleus, as well as of the other segment-spheres or cells which follow each other in the successive steps of germ-subdivision, it appears probable from the researches of several independent observers, and more especially of Edward Van Beneden and Oscar Hertwig, that, in the course of the extrusion of the germinal vesicle, a small portion of it remains behind in the form of a minute mass of hyaline substance, to which Van Beneden has given the name of *pronucleus*, and that, as the result of the fertilizing process, there is formed a second similar hyaline globule or pronucleus, situated near the surface, which gradually travels toward the centre and unites with the first pronucleus, and that these two pronuclei, being fused together, form the true nucleus of the first segment-sphere. According to this view the original germinal vesicle, when it disappears, or is lost to sight, as described by so many embryologists, is not dissipated, but only undergoes changes leading to the formation of the new and more highly-endowed nucleus of the first embryonic or segmental sphere. It further appears that the subdivision of each segmenting mass is preceded by a change and division of the nucleus, and that this division of the nucleus is accompanied by the peculiar phenomenon of a double conical or spindle-shaped radial lineation of the protoplasm, which, if we were inclined to speculate as to its nature, seems almost as if it marked out the lines of molecular force acting in the organizing process. These lines, however, it will be understood, if visible with the microscope, even of the highest magnifying power yet attained, belong to much larger particles than those of the supposed molecules of the physicist; but con-

[1] The more exact nature of the process of segmentation was first made known by the interesting researches of Bagge in 1841, and more especially of Kölliker in 1843. The phenomena of complete segmentation were first fully described in the mammal's ovum in Bischoff's "Description of the Development of the Rabbit," 1842, and followed out in his succeeding "Memoirs on the Dog, Guinea-pig, and Roe-deer." The phenomena of partial segmentation were first made known, in their more exact form, by Kölliker's "Researches on the Development of the Cephalopoda," published in 1844. In birds the process was first described by Bergmann in 1846, and more fully by Coste in 1848.

sidered in connection with what we know of the movements which frequently precede the act of division of the yolk-spheres, we seem in this phenomenon to have made some near approach to the observation of the direction in which the molecular forces operating in organization may be supposed to act.[1]

With respect to the nature of the blastoderm, the organized cellular stratum resulting from segmentation, and its relation to the previous condition of the ovum on the one hand, and the future embryo on the other, there is presented to us, by modern research, the interesting view that the blastoderm consists, after completion of the segmenting process, of two layers of cells, an outer, or upper, usually composed of smaller, clearer, and more compact nucleated cells, named *ectoderm*, or *epiblast*, and an inner, or lower, consisting of cells which are somewhat larger, more opaque, and granular, but also nucleated, and named *endoderm*, or *hypoblast*.

In the meroblastic ova, such as those of birds, the bilaminar blastoderm is discoid and circumscribed, as it lies on the yolk-surface, and only comes to envelop the whole of the food-yolk in the progress of later development; while in the holoblastic ova, and more especially in mammals, the blastoderm from the first extends over the whole surface of the yolk, and thus forms an entire covering of the yolk known as the "vesicular blastoderm;" the space within being occupied by fluid.

Huxley long ago presented the interesting view that these two layers are essentially the same in their morphological relations and histological structure with the double wall of the body in the simplest forms of animals above the protozoa; and Haeckel has more recently followed out this view, and supported it by his researches in the Calcareous Sponges, and has founded upon it his well-known *Gastræa* theory. According to this view, all animals take their origin from a form of *Gastrula*. In the simpler tribes, as in the instance of the common fresh-water polyp or hydra, they proceed no further than the gastrula stage, unless by mere enlargement and slight differentiation of the two primitive layers of cell, representing the persistent ectoderm and endoderm.[1]

If, pursuing this idea, we take a survey of the whole animal kingdom in its long gradation of increasing complexity of form and structure from the simplest animal up to man himself, we find that all the various modifications of organic structure which present themselves are found, in the history of the individual or ontological development of the different members of the series, to spring originally from two cellular laminæ, ectoderm and endoderm, the component elements of which may again be traced back to the first segment-sphere and primitive protoplasmic elements of the ovum.

Time does not admit of my conducting you through the chain of observation and reasoning by which Haeckel seeks to convince us of the universal applicability of his theory, but I cannot

[1] The observations referred to above as to the division of the nucleus are so novel, and of such deep interest, that I am tempted to add here a short abstract of their more important results from a very clear account given of them by Dr. John Priestley, of Owens College, Manchester, in the *Journal of Microscopical Science* for April, 1876.

The researches now referred to are those of Auerbach, Butschli, Strasburger, Hertwig, and Edward Van Beneden, and the following may be stated as the points in which they mainly agree:

The nucleus when about to divide elongates into a spindle-shaped body, becomes irregular and indistinct, acquires a granular disk or zone in the plane of its equator; this divides into two, and each half moves toward the pole of the spindle on its own side, there being radiated lines of protoplasm between the poles and the equatorial disk.

The disk-segments are the new nuclei, and the subsequent division of the cell takes place in the intermediate space.

Although these observers still differ in opinion upon some of the details of this process, and especially as to the fate of the germinal vesicle, all of them seem to agree that there are two pronuclei or distinct hyaline parts of the yolk-protoplasm, a superficial and a deep one, engaged in the formation of the new nucleus, and both Hertwig and Van Beneden are of opinion that the two proceed from different productive elements.

The radiated structure of the nuclei had been previously recognized by Fol and Flemming, and further observed by Oellacher.

1. Butschli's researches are published in the *Nov. Act. Nat. Cur.*, 1873, and in the *Zeitschr. für wissensch. Zool.*, vol. xxv.

2. Auerbach's observations in his *Organolog. Studien*, 1874.

3. Strasburger's observations in his memoir "Ueber Zellbildung und Zelltheilung," Jena, 1875.

4. Edward Van Beneden's researches, partly in his memoir "On the Composition and Significance of the Egg," etc., presented to the Belgian Academy in 1868, and more particularly in the extremely interesting preliminary account of "Researches on the Development of Mammalia," etc., 1875; and in a separate paper in the *Journal of Microscopical Science* for April, 876.

5. Oscar Hertwig's "Memoirs" are contained in the *Morpholog. Jahrbuch*, 1875, and his most interesting and novel observations in the same work, 1877.

[1] At this place I will only refer to one of the most recent of Haeckel's works, in which the views alluded to above are fully exposed in a series of most interesting memoirs, viz., "Studien zur Gastræa-Theorie," Jena, 1877.

avoid calling your attention to the extremely interesting relation which has been shown to exist between the primary phases of development of the ovum and the foundation of the blastoderm in very different groups of animals, more especially by the researches of Haeckel himself, of Kowalevsky, Edward van Beneden, and others, and which has received most efficient support from the investigations and writings of E. Ray Lankester in our own country; so that now we may indulge the well-grounded expectation that, notwithstanding the many and great difficulties which doubtless still present themselves in reconciling various forms with the general principle of the theory, we are at least in the track which may lead to a consistent view of the relations subsisting between the ontogenetic, or individual, and the phylogenetic, or race, history of the formation of animals and of man.[1]

In all animals, then, above the protozoa, the ovum presents, in some form or other, the bilaminar structure of ectoderm and endoderm at a certain stage of its development, this structure resulting from a process of segmentation or cell-cleavage; and there are three principal modes in which the double condition of the layers is brought about. In one of these it is by inward folding or invagination of a part of the single layer of cells immediately resulting from the process of segmentation that the doubling of the layers is produced; in the second, perhaps resolvable into the first, it may be described rather as a process of inclosure of one set of cells within another; while in the third the segmented cells, arranged as a single layer round a central cavity of the ovum, divide themselves later into two layers. But the distinction of ectodermic and endodermic layers of cells is maintained, whether it be primitive and manifested from a very early period, or acquired later by a secondary process of differentiation. Thus, in many invertebrates, as also in *Amphioxus* among the vertebrates, a distinct invagination occurs, while in mammals, as recently shown by Van Beneden's most interesting observations in the rabbit's ovum, and probably also in some invertebrates, the cells of the ectoderm gradually spread over those of the endoderm during the progress of segmentation, and thus the endodermic comes to be inclosed by the ectodermic layer of cells.

[1] I ought here to refer to the elaborate memoirs of Prof. Semper on the morphological relations of the vertebrate and invertebrate animals contained in the "Arbeiten aus dem zoolog. zootom. Institut in Würzburg," 1875 and 1876, in which the conclusions arrived at do not coincide with the views above stated.

From the very novel and unexpected observations of Van Beneden, it further appears that from the earliest period in the process of segmentation in the mammal's ovum it is possible to perceive a distinction of two kinds of segment-spheres, or cells, and that when this process is traced back to its first stage it is found that the whole of the cells belonging to the ectoderm are the progeny of, or result from, the division of the upper of the two first-formed segments, and that the whole of the endodermic cells are the descendants of the lower of the first two segmented cells. This, however, is not an isolated fact belonging only to mammalian development, but one which very nearly repeats a process ascertained to occur in a considerable number of the lower animals, and it seems to promise the means of greatly advancing the comprehension of the whole process of blastodermic formation. Thus, ectoderm and endoderm, or the primordial rudiments of the future animal and vegetative systems of the embryo, are traced back as distinct from each other to the first stage of segmentation of the germ.

Accepting these facts as ascertained, they may be regarded as of the deepest significance in the phylogenetic history of animals; for they appear to open up the prospect of our being able to trace transitions between the earliest embryonic forms occurring in the most different kinds of ova, as between the discoid or meroblastic, and the vesicular or holoblastic, through the intermediate series, which may be termed amphiblastic ova.

In the lowest animals, the two layers already mentioned, viz., ectoderm and endoderm, are the only ones known to constitute the basis of developmental organization; but as we rise in the scale of animals we find a new feature appearing in their structure which is repeated also in the history of the formation of the blastoderm in the higher animals up to man. This consists in the formation of an intermediate layer or layers constituting the *mesoderm*, with which, in by far the greater number, is connected the formation of some of the most important bodily structures, such as the osseous, muscular, and vascular systems.

I will not stop to discuss the very difficult question of the first origin of the mesoderm, upon which embryologists are not yet entirely agreed, but will only remark that a view originally taken of this subject by the acute Von Baer appears more and more to gain ground; and it is this—that the mesoderm, arising as a secondary structure, that is, later than the two primary layers of ectoderm and endoderm (corresponding to the

serous and mucous layers of Pander), is probably connected with or derived from both of these primitive layers, a view which it will afterward appear is equally important ontogenetically and phylogenetically.

But whatever may be the first origin of the mesoblast, we know that in the vertebrata this layer, separating from between the other two, and acquiring rapidly by its cell-multiplication larger proportions and much greater complexity than belong to either ectoderm or endoderm, speedily undergoes further subdivision and differentiation in connection with the appearance of the embryonic organs which arise from it, and in this respect contrasts greatly with the simplicity of structure which remains in the developed parts of the ectodermic and endodermic layers. Thus, while the ectoderm supplies the formative materials for the external covering or epidermis, together with the rudiments of the central nervous organs and principal sense-organs, and the endoderm by itself only gives rise to the epithelial lining of the alimentary canal and the cellular part of the glands connected with it, the mesoblast is the source of far more numerous and complex parts, viz., the whole of the true skin or corium, the vertebral column and osseous system, the external voluntary muscles and connective tissue, the muscular walls of the alimentary canal, the heart and blood-vessels, the kidneys, and the reproductive organs, thus forming much the greatest bulk of the body in the higher animals.[1]

There is, however, a peculiarity in the mode of the earliest development of the mesoblast which is of great importance in connection with the general history of the disposition of parts in the animal body to which I must now refer. This consists in the division of the mesoblast in all but its central part into two laminæ, an outer or upper and an inner or lower, and the separation of these by an interval or cavity which corresponds to the space existing between the outer wall of our bodies and the deeper viscera; and which from the point of view of the vertebrate animals is called the pleuro-peritoneal cavity, but, viewed in the more extended series of animals down to the annuloida, may receive the more general appellation of pleuro-splanchnic or parieto-visceral cavity, or, shortly, the *cœlom*. Thus, from an early period in the vertebrate embryo, and in a considerable number of the invertebrate, a division of the mesoderm takes place into the somato-pleural or outer lamina, and the splanchno-pleural or inner lamina; the outer being the seat of formation of the dermal, muscular, and osseous systems—the volunto-motory of Remak; and the inner of the muscular wall of the alimentary canal, as well as of the contractile substance of the heart and the vascular system generally.

It is interesting to find that there is a correspondence between the later division of the mesoderm of the higher animals derived from the two primitive blastodermic laminæ, and the original absence of mesodermic structure in the lowest animals, followed by the gradual appearance, first of one layer (the external muscular in the higher cœlenterata), and soon afterward by the two divisions or laminæ with the intermediate cœlom.

In this account of what may be termed the organized foundation of the new being, I have entered into some detail, because I felt that our conception of any relation subsisting between the ontogenetic history of animals and their phylogenetic evolution can only be formed from the careful study of the earliest phenomena of embryonic organization. But, notwithstanding the many difficulties which unquestionably still block the way, I am inclined to think that there is great probability in the view of a common bilaminar origin for the embryo of all animals above the protozoa, and that the vertebrate equally with the invertebrate animals may be shown to possess in the first stages of their blastodermic or embryonic formation the two primitive layers of ectoderm and endoderm.

To attempt, however, to pursue the history of the development of animals in detail would be equivalent to inflicting upon you a complete system of human and comparative anatomy. But I cannot leave the subject abruptly without an endeavor to point out in the briefest possible manner the bearing of one or two of the leading facts in embryology upon the general relation of ontogeny and phylogeny.

We are here brought into the contemplation of those remarkable changes, all capable of being observed and demonstrated, by which the complex organization of the body is gradually built up out of the elementary materials furnished by

[1] If we reserve the words ectoderm and endoderm to designate the two layers of the primary bilaminar blastoderm, we may apply the terms epiblast and hypoblast to their derivatives after the formation of the mesoderm, and indicate the relations of the whole to the secondary or quadrilaminar blastoderm, by the accompanying table:

Primary Blastoderm.	Ectoderm	.....	Epiblast.....	Secondary Blastoderm.
	Mesoderm.		Somatopleure....	
			Splanchnopleure.	
	Endoderm	.....	Hypoblast.....	

the blastodermic layers—a process which has been looked upon by all those who have engaged in its study with the greatest interest and admiration. And if, by comparing these phenomena as observed in individuals belonging to different classes and orders of animals, it is found not only that they are not different, but, on the contrary, that they present features of the most remarkable resemblance and conformity, we shall be led to conclude that there is a general plan of development proved to extend to the members of considerable groups, and possibly capable of being traced from one group to another. But this is clearly nothing else than another way of stating that there is a similar type of structure pervading the animals of each group, and a probability of a common type being ascertained to belong to them all. The main question, therefore, to be answered is, whether there is or is not a general correspondence between the phenomena of development and the gradation of type in animal structure upon which anatomists and zoölogists are agreed; and my object will now be to bring rapidly before you one or two of the most marked illustrations of the correspondence, drawn from the early history of development in the higher animals.

As one of the examples of the earlier phenomena of development I may refer to the change which is perceptible as early as the eighteenth or twentieth hour of incubation in the chick, and which is reproduced in the course of development of every member of the vertebrate sub-kingdom. It consists in the formation of cross-clefts on each side of the primitive neural cavity which divide off from each other a number of segments of this wall in the length of the axis of the embryo. At first there are only one or two such clefts; but they rapidly increase in a backward direction in the body of the embryo, and as development proceeds they extend into the tail itself. These are the *protovertebræ* of embryologists, not corresponding, as might at first be supposed, with the true or actual vertebræ which are formed later, but representing in an interesting manner transverse *vertebral segments* of the body, and containing within each the elements of a great part of the structure belonging to the body-wall afterward to be developed, including the true cartilaginous or osseous vertebral arches, and the muscular plates.

This change, however, belongs to the mesodermic lamina, and occurs in an elongated thick portion of it, which makes its appearance on each side of the primitive neural canal between the epiblast and the hypoblast. The transverse cleavage is ascertained to commence near what afterward forms the first cervical vertebra, but does not extend into the base of the cranium. And it is most interesting to note in this cleavage the formation at so early a period of the succession of *metameres* or series of similar parts, which forms a main characteristic of vertebral organization.

As intimately connected with the formation of the vertebral column, the appearance of the chorda dorsalis, or *notochord*, presents many points of peculiar interest in embryological inquiries.

The notochord is a continuous median column or thread of cellular structure, running nearly the whole length of the rudimentary body of the embryo, and lying immediately below the cerebro-spinal canal. It occupies, in fact, the centre of the future bodies of the vertebræ. It exists as a primordial structure in the embryo of all vertebrates, including man himself, and extending down to the amphioxus, and, according to the remarkable discovery of Kowalevsky in 1866, it is to be found among the invertebrates in the larva of the ascidia.[1]

In amphioxus and the cyclostomatous fishes the notochord, growing with the rest of the body into a highly-developed form, acts as a substitute for the pillar of the bodies of the vertebræ, no vertebral bodies being developed; but in cartilaginous and osseous fishes various gradations of cartilaginous and osseous structures come to surround the notochord and give rise to the simpler forms of vertebral bodies, which undergo more and more distinct development in the higher vertebrates. In all instances the substance forming the vertebral bodies is deposited on the surface of or outside the notochord and its sheath, so that this body remains for a time as a vestigial structure within the vertebral bodies of the higher animals.

The observations of Kowalevsky with respect to the existence of a notochord in the ascidia, which have been confirmed by Kupfer and others, have produced a change little short of revolutionary in embryological and zoölogical views, leading as they do to the support of the hypothesis that the ascidia is an earlier stage in the phylogenetic history of the mammal and other vertebrates. The analogy between the amphioxus and ascidian larva is certainly most curious and striking as regards the relation of the notochord to other parts, and it is not difficult to conceive such a change in the form and position of the organs in their passage from the embryonic to

[1] "Mémoires de l'Académie de St.-Pétersbourg," vol. x.

the adult state as is not inconsistent with the supposition that the vertebrates and the ascidia may have had a common ancestral form. Kowalevsky's discovery opens up at least an entirely new path of inquiry; and we must be prepared to modify our views as to the entire separation of the vertebrates from the other groups of animals, if we do not at once adopt the hypothesis that through the ascidian and other forms the origin of the vertebrates may be traced downward in the series to the lower grades of animal organization.

The notochord extends a short way forward into the cranial basis, and an interesting question here presents itself, beginning with the speculations of Goethe and Oken, and still forming a subject of discussion, whether the series of cranial or cephalic bones is comparable to that of the vertebræ. On the whole it appears to me that it is consistent with the most recent views of the development and anatomy of the head to hold the opinion that it is composed of parts which are to some extent homologous with vertebral metameres.[1]

The history of the formation of the vertebral column presents an interesting example of the correspondence in the development of the individual and the race, in that all the stages which have been referred to, as occurring in the gradual evolution of the vertebral column in the series of vertebrates, are repeated in the successive stages of the embryonic development of the higher members of the series.

There is perhaps no part of the history of development in the vertebrates which illustrates in a more striking manner the similarity of plan which runs through the whole of them than that connected with what I may loosely call the region of the face and neck, including the apparatus of the jaws and gills. The embryonic parts I now refer to consist of a series of symmetrical pairs of plates which are developed at an early period below the cranium, and may, therefore, in stricter embryological terms, be styled the *subcranial plates*.

Without attempting to follow out the remarkable changes which occur in the development of the nose and mouth in connection with the anterior set of these plates, which, from being placed before the mouth, are sometimes named *preoral*, I may here refer shortly to the history of the plates situated behind the mouth, which were discovered by Rathke in 1826, and formed the subject of an elaborate investigation by Reichert in 1837.

These plates consist of a series of symmetrical bars, four in number in mammals and birds, placed immediately behind the mouth, separated by clefts passing through the wall of the throat, and each traversed by a division of the great artery from the heart; thus constituting the type of a branchial apparatus, which in fishes and amphibia becomes converted into the well-known gills of these animals, while in reptiles, birds, and mammals, they undergo various changes leading to the formation of very different parts, which could not be recognized as having any relation to gill-structure but for the observation of their earlier embryonic condition. The history of this part of development also possesses great interest on account of the extraordinary degree of general resemblance which it gives to the embryos of the most different animals at a certain stage of advancement—so great, indeed, that it requires a practised eye to distinguish between the embryos of very different orders of mammals, and even between some of them and the embryos of birds or reptiles, as well as in connection with the transformations of the first pair of branchial apertures, which lead to the formation of the passage from the throat to the ear in the higher vertebrata. There is equal interest attached to the history of the development of the first pair of arches which include the basis of formation of the lower jaw with the so-called *cartilage of Meckel*, and which, while furnishing the bone which suspends the lower jaw in reptiles and birds, is converted in mammals into the hammer-bone of the ear.

The other arches undergo transformations which are hardly less marvelous, and the whole series of changes is such as never fails to impress the embryological inquirer with a forcible idea of the persistence of type and the inexhaustible variety of changes to which simple and fundamental parts may be subject in the process of their development.

It is also of deep significance, in connection with the foregoing phenomena, to observe the increase in the number of the gill-bars and apertures as we descend in the scale to the cartilaginous fishes and lampreys, and the still further multiplication of these metameres or repeated parts in the amphioxus; and it is, perhaps, also interesting to note that in the ascidia the ar-

[1] *See* the interesting and valuable memoirs of W. K. Parker, "On the Anatomy and Development of the Vertebrate Skull," in "Transactions" of Royal Society, the researches of Gegenbaur, Mihalkovics, and more particularly the memoir by F. M. Balfour, "On the Development of the Elasmobranchs," in the *Journal of Anatomy and Physiology*, vols. x. and xi.

rangement of the gills is exactly similar to that of the amphioxus.

The study of the comparative anatomy of the heart and its mode of formation in the embryo furnishes also most striking illustrations of the relation between ontogenetic and phylogenetic development in the vertebrates, and is not without its applications to some of the invertebrate groups of animals.

I need only recall to your recollection the completely double state of this organ in warm-blooded animals, by which a regular alternation of the systemic and pulmonary circulations is secured, and the series of gradations through the class of reptiles by which we arrive at the undivided ventricle of the amphibian, and the further transition in the latter animals by which we come at last to the single heart of fishes; and to state that in the embryo of the higher animals the changes by which the double heart is ultimately developed out of an extremely simple tubular form into which it is at first moulded from the primitive-formative cells are, in the inverse order, entirely analogous to those which I have just now indicated as traceable in the descending series of vertebrate animals; so that at first the embryonic heart of man and other warm-blooded animals is nothing more than a rhythmically contractile vascular tube. By the inflection of this tube, the constriction of its wall at certain parts, and the dilatation at others, the three chambers are formed which represent the single auricle, the single ventricle, and the aortic bulb of the fish. By later changes a septum is formed to divide the auricles, becoming completed in all the air-breathing animals, but remaining incomplete in the higher animals so long as the conditions of fœtal life prevent the return of arterialized blood to the left auricle. The growth of another septum within the ventricular portion gradually divides that cavity into two ventricles, repeating somewhat in its progress the variations observed in different reptiles, and attaining its complete state in the crocodile and warm-blooded animals.

I must not attempt to pursue this interesting subject further, but I cannot avoid making reference to the instructive view presented by the embryological study of the nature of the malformations to which the heart is subject, which, as in many other instances, are due to the persistence of transitory conditions which belong to different stages of progress in the development of the embryo. Nor can I do more than allude to the interesting series of changes by which the aortic bulb, remaining single in fishes, and serving as the channel through which the whole stream of blood leaving the heart is passed into the gills, becomes divided in the higher animals into the roots of the two great vessels, the aorta and the pulmonary artery, and the remarkable transformations of the vascular arches which proceed from the aortic bulb along the several branchial arches, and which, in the gills of fishes and aquatic amphibia, undergo that minute subdivision which belongs to the vascular distribution of gills, but which in the higher non-branchiated animals are the subject of very different and various changes in the partial obliteration of some, and the enlargement of others, by which the permanent vessels are produced.

These changes and transformations have for many years been a subject of much interest to comparative anatomists, and will continue to be so, not only from their presenting to us one of the most remarkable examples of conformity in the plan of development and the type of permanent or completed organization in the whole series of vertebrated animals, but also because of the manifest dependence of the phenomena of their development upon external influences and atmospheric conditions which affect the respiration, nutrition, and modes of life, of the animal.

Nor is the correspondence to which I now refer entirely limited to the vertebrata. For here, again, through the amphioxus and the ascidia, we come to see how an affinity may be traced between organs of circulation and respiration which at first appear to belong to very different types. The heart of vertebrates is, as is well known, an essentially concentrated form of vascular development in the ventral aspect of the body; while the heart of the invertebrate, whether in the more concentrated form existing in the articulata and muscula, or in a more subdivided shape prevalent in the annelida, is most frequently dorsal; yet the main aorta of the vertebrates is also dorsal; and it is not impossible, through the intermediate form of amphioxus, to understand how the relation between the vertebrate and the invertebrate type of the blood-vascular system may be maintained.

But I am warned by the lapse of time that I must not attempt to pursue these illustrations further. In the statement which I have made of some of the more remarkable phenomena of organic production—too long, I fear, for your endurance, but much too brief to do justice to the subject—it has been my object mainly to

show that they are all more or less closely related together by a chain of similarity of a very marked and unmistakable character; that in their simplest forms they are indeed, in so far as our powers of observation enable us to know them, identical; that in the lower grades of animal and vegetable life they are so similar as to pass by insensible gradations into each other; and that in the higher forms, while they diverge most widely in some of their aspects in the bodies belonging to the two great kingdoms of organic Nature, and in the larger groups distinguishable within each of them, yet it is still possible, from the fundamental similarity of the phenomena, to trace in the transitional forms of all their varieties one great general plan of organization.

In its simplest and earliest form that plan comprises a minute mass of the common nitrogenous hydrocarbon compound to which the name of protoplasm has been given, exhibiting the vital properties of assimilation, reproduction, and irritability; the second stage in this plan is the nucleated and inclosed condition of the protoplasmic mass in the organized cell. We next recognize the differentiation of two productive elements, and their combination for the formation of a more highly-endowed organizing element in the embryonic germ-sphere or cell; and the fourth stage of advance in the complexity of the organizing phenomena is in the multiplication of the fertilized embryo-cell, and its conversion into continuous organized strata, by further histological changes in which the morphological foundations of the future embryo or new being are laid.

I need not now recur to the further series of complications in the formative process by which the bilaminar blastoderm is developed, and becomes trilaminar or quadrilaminar, but only recall to your recollection that while these several states of the primordial condition of the incipient animal pass insensibly into each other, there is a pervading similarity in the nature of the histological changes by which they are reached, and that in the production of the endless variations of form assumed by the organs and systems of different animals in the course of their development, the process of cell-production, multiplication, and differentiation, remains identical. The more obvious morphological changes are of so similar a character throughout the whole, and so nearly allied in the different larger groups, that we are led to regard them as placed in some very close and intimate relation to the inherent properties of the organic substance which is their seat, and the ever-present influence of the vital conditions in which alone these properties manifest themselves.

The formative or organizing property, therefore, resides in the living substance of every organized cell and in each of its component molecules, and is a necessary part of the physical and chemical constitution of the organizing elements in the conditions of life; and it scarcely needs to be said that these conditions may be as varied as the countless numbers of the molecules which compose the smallest particles of their substance. But, setting aside all speculation of a merely pangenetic kind, it appears to me that no one could have engaged in the study of embryological development for any time without becoming convinced that the phenomena which have been ascertained as to the first origin and formation of textures and organs in any individual animal are of so uniform a character as to indicate forcibly a law of connection and continuity between them; nor will his study of the phenomena of development in different animals have gone far before he is equally strongly convinced of the similarity of plan in the development of the larger groups, and, to some extent, of the whole. I consider it impossible, therefore, for any one to be a faithful student of embryology, in the present state of science, without at the same time becoming an evolutionist. There may still be many difficulties, some inconsistencies, and much to learn, and there may remain beyond much which we shall never know; but I cannot conceive any doctrine professing to bring the phenomena of embryonic development within a general law which is not, like the theory of Darwin, consistent with their fundamental identity, their endless variability, their subjugation to varying external influences and conditions, and with the possibility of the transmission of the vital conditions and properties, with all their variations, from individual to individual, and, in the long lapse of ages, from race to race.

I regard it, therefore, as no exaggerated representation of the present state of our knowledge to say that the ontogenetic development of the individual in the higher animals repeats in its more general character, and in many of its specific phenomena, the phylogenetic development of the race. If we admit the progressive nature of the changes of development, their similarity in different groups, and their common characters in all animals, nay, even in some respects in both plants and animals, we can scarcely refuse to recognize the possibility of continuous derivation in the history of their origin; and however far

we may be, by reason of the imperfection of our knowledge of paleontology, comparative anatomy, and embryology, from realizing the precise nature of the chain of connection by which the actual descent has taken place, still there can be little doubt remaining in the minds of any unprejudiced student of embryology that it is only by the employment of such an hypothesis as that of evolution that further investigation in these several departments will be promoted so as to bring us to a fuller comprehension of the most general law which regulates the adaptation of structure to function in the universe.

—*Nature.*

A MODERN "SYMPOSIUM."

THE SOUL AND FUTURE LIFE.[1]

MR. R. H. HUTTON.—The imaginative glow and rhetorical vivacity which are visible throughout Mr. Harrison's essays on "The Soul and Future Life" are very remarkable, and should guard those of us who recoil in amazement from its creed or no-creed from falling into the very common mistake of assuming that the effect which such ideas as these produce on ourselves is *the* effect which, apart from all question of the other mental conditions surrounding the natures into which they are received, they naturally produce. It is clear, at least, that if they ever tended to produce on the author of these papers the same effect which they not only tend to produce, but do produce, on myself, that tendency must have been so completely neutralized by the redundant moral energy inherent in his nature, that the characteristic effect which I should have ascribed to them is absolutely unverifiable, and, for anything we have the right to assert, non-existent. There is at least but one instance in which I should have traced any shade of what I may call the natural view of death as presented in the light of this creed, and that is the sentence in which Mr. Harrison somewhat superfluously disclaims—and, moreover, with an accent of *hauteur*, as though he resented the necessity of admitting that death is a disagreeable certainty—his own or his creed's responsibility for the fact of death. "We make no mystical or fanciful divinity of death," he says;[2] "we do not deny its terrors or its evils. We are not responsible for it, and should welcome any reasonable prospect of eliminating or postponing this fatality that waits upon all organic nature." After reading that admission, I was puzzled when I came to the assertion that "we who know that a higher form of activity is only to be reached by a subjective life in society, will continue to regard a perpetuity of sensation as the true hell,"[1] a sentence in which Mr. Harrison would commonly be understood to mean that he and all his friends, if they had a vote in the matter, would give a unanimous suffrage against this "perpetuity of sensation," and, so far from trying to eliminate or postpone death, would be inclined to cling to and even hasten it. For, in this place at least, it is not the perpetuation of deteriorated energies of which Mr. Harrison speaks, but the perpetuation of life pure and simple. Indeed, nothing puzzles me more in this paper than the diametrical contradictions, both of feeling and thought, which appear to me to be embodied in it. Its main criticism on the common view of immortality seems to be that the desire for it is a grossly selfish desire. Nay, nicknaming the conception of a future of eternal praise, "the eternity of the tabor," he calls it[2] a conception "so gross, so sensual, so indolent, so selfish," as to be worthy of nothing but scorn. I think he can never have taken the trouble to realize with any care what he is talking of. Whatever the conception embodied in what Mr. Harrison calls "ceaseless psalmody"[3] may be—and certainly it is not my idea of immortal life—it is the very opposite of selfish. No conception of life can be selfish of which the very essence is adoration, that is, wonder, veneration, gratitude, to another. And gross as the conception necessarily suggested by psalm-singing is, to those who interpret it, as we generally do, by the stentorian shoutings of congregations who are often thinking a great deal more of their own per-

[1] *See* Mr. Frederic Harrison's papers in Nos. III. and IV. of the SUPPLEMENT. This discussion will be continued and concluded in a future number of this magazine.

[2] SUPPLEMENT No. IV., p. 311.

[1] P. 314. [2] P. 314. [3] P. 313.

formances than of the object of their praise, it is the commonest candor to admit that this conception of immortality owes its origin entirely to men who were thinking of a life absorbed in the interior contemplation of a God full of all perfections—a contemplation breaking out into thanksgiving only in the intensity of their love and adoration. Whatever else this conception of immortality may be, the very last phrase which can be justly applied to it is "gross" or "selfish." I fear that the positivists have left the Christian objects of their criticism so far behind that they have ceased not merely to realize what Christians mean, but have sincerely and completely forgotten that Christians ever had a meaning at all. That positivists should regard any belief in the "beatific vision" as a wild piece of fanaticism, I can understand, but that, entering into the meaning of that fanaticism, they should describe the desire for it as a gross piece of selfishness, I cannot understand; and I think it more reasonable, therefore, to assume that they have simply lost the key to the language of adoration. Moreover, when I come to note Mr. Harrison's own conception of the future life, it appears to me that it differs only from the Christian's conception by its infinite deficiencies, and in no respect by superior moral qualities of any kind. That conception is, in a word, posthumous energy. He holds that if we could get rid of the vulgar notion of a survival of personal sensations and of growing mental and moral faculties after death, we should consecrate the notion of posthumous activity, and anticipate with delight our "coming incorporation with the glorious future of our race,"[1] as we cannot possibly consecrate those great hopes now.

But, in the first place, what is this "glorious future of our race" which I am invited to contemplate? It is the life in a better organized society of a vast number of these merely temporary creatures whose personal sensations, if they ever could be "perpetuated," Mr. Harrison regards as giving us the best conception of a "true hell." Now, if an improved and better organized future of ephemerals be so glorious to anticipate, what elements of glory are there in it which would not belong to the immortality looked forward to by the Christian—a far more improved future of endlessly growing natures? Is it the mere fact that I shall myself belong to the one future which renders it unworthy, while the absence of any "perpetuity" of my personal "sensations" from the other renders it unselfish? I always supposed selfishness to consist, *not* in the desire for any noble kind of life in which I might share, but in the preference for my own happiness at the *expense* of some one else's. If it is selfish to desire the perpetuation of a growing life, which not only does not, as far as I know, interfere with the volume of moral growth in others, but certainly contributes to it, then it must be the true unselfishness to commit suicide at once, supposing suicide to be the *finis* to personal "sensation." But then universal suicide would be inconsistent with the glorious future of our race, so I suppose it must at least be postponed till our own sensations have been so far "perpetuated" as to leave heirs behind them. If Condorcet is to be held up to our admiration for anticipating on the edge of the grave his "coming incorporation with the glorious future of his race," i. e., with ourselves and our posterity, may we not infer that there is something in ourselves, i. e., in human society as it now exists, which is worthy of his vision—something in which we need not think it "selfish" to participate, even though our personal "sensations" do form a part of it? Where, then, does the selfishness of desiring to share in a glorious future even through personal "sensations" begin? The only reasonable or even intelligible answer, as far as I can see, is this: as soon as that personal "sensation" for ourselves excludes a larger and wider growth for others, but no sooner. But then no Christian ever supposed for a moment that his personal immortality could or would interfere with any other being's growth. And if so, where is the selfishness? What a Christian desires is a higher, truer, deeper union with God for all, himself included. If his own life drop out of that future, he supposes that there will be so much less that really does glorify the true righteousness, and no compensating equivalent. If it be Mr. Harrison's mission to disclose to us that any perpetuity of sensation on our own parts will positively exclude something much higher which *would* exist if we consented to disappear, he may, I think, prove his case. But in the absence of any attempt to do so, his conception that it is noble and unselfish to be more than content—grateful—for ceasing to live any but a posthumous life seems to me simply irrational.

But, further, the equivalent which Mr. Harrison offers me for becoming, as I had hoped to become, in another world, an altogether better member of a better society, does not seem to me more than a very doubtful good. My posthumous activity will be of all kinds, some of which I am glad to anticipate, most of which I am very sorry to an-

[1] P. 313.

ticipate, and much of which I anticipate with absolute indifference. Even our best actions have bad effects as well as good. Macaulay and most other historians held that the Puritan earnestness expended a good deal of posthumous activity in producing the license of the world of the Restoration. Our activity, indeed, is strictly posthumous in kind, even before our death, from the very moment in which it leaves our living mind and has begun to work beyond ourselves. What I did as a child is, in this sense, as much producing posthumous effects, i. e., effects over which I can no longer exert any control, now, as what I do before death will be producing posthumous effects after my death. Now, a considerable proportion of these posthumous activities of ours, even when we can justify the original activity as all that it ought to have been, are unfortunate. Mr. Harrison's papers, for instance, have already exerted a very vivid and very repulsive effect on my mind—an activity which I am sure he will not look upon with gratification, and I do not doubt that what I am now writing will produce the same effect on him, and in that effect I shall take no delight at all. A certain proportion, therefore, of my posthumous activity is activity for evil, even when the activity itself is on the whole good. But when we come to throw in the posthumous activity for evil exerted by our evil actions and the occasional posthumous activity for good which evil also fortunately exerts, but for the good results of which we can take no credit to ourselves, the whole constitutes a *mélange* to which, as far as I am concerned, I look with exceedingly mixed feelings, the chief element being humiliation, though there are faint lights mingled with it here and there. But as for any rapture of satisfaction in contemplating my "coming incorporation with the glorious future of our race," I must wholly and entirely disclaim it. What I see in that incorporation of mine with the future of our race—glorious or the reverse, and I do not quite see why the positivist thinks it so glorious, since he probably holds that an absolute term must be put to it, if by no other cause, by the gradual cooling of the sun—is a very patchwork sort of affair indeed, a mere miscellany of bad, good, and indifferent, without organization and without unity. What I shall be, for instance, when incorporated, in Mr. Harrison's phrase, with the future of our race, I have very little satisfaction in contemplating, except so far, perhaps, as my "posthumous activity" may retard the acceptance of Mr. Harrison's glorious anticipations for the human race. One great reason for my personal wish for a perpetuity of volition and personal energy is, that I may have a better opportunity, as far as may lie in me, to undo the mischief I shall have done before death comes to my aid. The vision of "posthumous activity" ought indeed, I fancy, to give even the best of us very little satisfaction. It may not be, and perhaps is not, so mischievous as the vision of "posthumous fame," but yet it is not the kind of vision which, to my mind, can properly occupy very much of our attention in this life. Surely the right thing for us to do is to concentrate attention on the life of the living moment—to make that the best we can—and then to leave its posthumous effects, after the life of the present has gone out of it, to that power which, far more than anything in it, transmutes at times even our evil into good, though sometimes, too, to superficial appearance at all events, even our good into evil. The desire for an immortal life—that is, for a perpetuation of the personal affections and of the will—seems to me a far nobler thing than any sort of anticipation as to our posthumous activity; for high affections and a right will are good in *themselves*, and constitute, indeed, the only elements in Mr. Harrison's "glorious future of our race" to which I can attach much value—while posthumous activity may be either good or evil, and depends on conditions over which he who first puts the activity in motion often has no adequate control.

And this reminds me of a phrase in Mr. Harrison's paper which I have studied over and over again without making out his meaning. I mean his statement that on his own hypothesis "there is ample scope for the spiritual life, for moral responsibility, for the world beyond the grave, *its hopes and its duties*, which remain to us perfectly real without the unintelligible hypothesis." [1] Now, I suppose, by "the hopes" of "the world beyond the grave," Mr. Harrison means the hopes we form *for* the "future of our race," and that I understand. But what does he mean by its "duties?" Not, surely, our duties beyond the grave, but the duties of those who survive us; for he expressly tells us that our mental and moral powers do not increase and grow, develop or vary within themselves—do not, in fact, survive at all except in their effects—and hence duties for *us* in the world beyond the grave are, I suppose, in his creed impossible. But if he only means that there will be duties for those who survive us after we are gone, I cannot see how that is in any respect a theme on which it is either profitable or consolatory for us to dwell by

[1] No. III., p. 242.

anticipation. One remark more: When Mr. Harrison says [1] that it is quite as easy to learn to long for the moment when you shall become "the immaterial principle of a comet," or that you "really were the ether, and were about to take your place in space," as to long for personal immortality—he is merely talking at random on a subject on which it is hardly seemly to talk at random. He knows that what we mean by the soul is that which lies at the bottom of the sense of personal identity—the thread of the continuity running through all our checkered life; and how it can be equally unmeaning to believe that this hitherto unbroken continuity will continue unbroken, and to believe that it is to be transformed into something else of a totally different kind, I am not only unable to understand, but even to understand how he could seriously so conceive us. My notion of myself never had the least connection with the principle of any part of any comet, but it has the closest possible connection with thoughts, affections, and volitions, which, as far as I know, are not likely to perish with my body. I am sorry that Mr. Harrison should have disfigured his paper by sarcasms so inapplicable and apparently so bitter as these.

PROF. HUXLEY.—Mr. Harrison's striking discourse on "The Soul and Future Life" has a certain resemblance to the famous essay on the snakes of Iceland. For its purport is to show that there is no soul, nor any future life, in the ordinary sense of the terms. With death, the personal activity of which the soul is the popular hypostasis is put into commission among posterity, and the future life is an immortality by deputy.

Neither in these views nor in the arguments by which they are supported is there much novelty. But that which appears both novel and interesting to me is the author's evidently sincere and heart-felt conviction that his powerful advocacy of soulless spirituality and mortal immortality is consistent with the intellectual scorn and moral reprobation which he freely pours forth upon the "irrational and debasing physicism" of materialism and materialists, and with the wrath with which he visits what he is pleased to call the intrusion of physical science, especially of biology, into the domain of social phenomena.

Listen to the storm:

"We certainly do reject, as earnestly as any school can, that which is most fairly called materialism, and we will second every word of those who cry out that civilization is in danger if the workings of the human spirit are to become questions of physiology, and if death is the end of a man, as it is the end of a sparrow. We not only assent to such protests, but we see very pressing need for making them. It is a corrupting doctrine to open a brain, and to tell us that devotion is a definite molecular change in this and that convolution of gray pulp, and that, if man is the first of living animals, he passes away after a short space like the beasts that perish. And all doctrines, more or less, do tend to this, which offer physical theories as explaining moral phenomena, which deny man a spiritual in addition to a moral nature, which limit his moral life to the span of his bodily organism, and which have no place for 'religion' in the proper sense of the word." [1]

Now, Mr. Harrison can hardly think it worth while to attack imaginary opponents, so that I am led to believe that there must be some body who holds the "corrupting doctrine" "that devotion is a definite molecular change in this and that convolution of gray pulp." Nevertheless, my conviction is shaken by a passage which occurs at page 239: "No rational thinker now pretends that imagination *is* simply the vibration of a particular fibre." If no rational thinker pretends this of imagination, why should any pretend it of devotion? And yet I cannot bring myself to think that all Mr. Harrison's passionate rhetoric is hurled at irrational thinkers: surely he might leave such to the soft influences of time and due medical treatment of their "gray pulp" in Colney Hatch or elsewhere.

On the other hand, Mr. Harrison cannot possibly be attacking those who hold that the feeling of devotion is the concomitant, or even the consequent, of a molecular change in the brain; for he tells us, in language the explicitness of which leaves nothing to be desired, that

"To positive methods every fact of thinking reveals itself as having functional relation with molecular change. Every factor of will or feeling is in similar relation with kindred molecular facts." [2]

On mature consideration, I feel shut up to one of two alternative hypotheses. Either the "corrupting doctrine" to which Mr. Harrison refers is held by no rational thinker—in which case, surely, neither he nor I need trouble ourselves about it—or the phrase, "Devotion *is* a definite molecular change in this and that convolution of gray pulp," means that devotion has a functional relation with such molecular change; in which case it is Mr. Harrison's own view, and

[1] No. IV., p. 315.

[1] No. III., p. 241. [2] P. 239.

therefore, let us hope, cannot be a "corrupting doctrine."

I am not helped out of the difficulty I have thus candidly stated, when I try to get at the meaning of another hard saying of Mr. Harrison's, which follows after the "corrupting doctrine" paragraph: "And all doctrines, more or less, do tend to this [corrupting doctrine], which offer physical theories as explaining moral phenomena."

Nevertheless, on p. 239, No. III., Mr. Harrison says with great force and tolerable accuracy:

"Man is one, however compound. Fire his conscience, and he blushes. Check his circulation, and he thinks wildly, or thinks not at all. Impair his secretions, and moral sense is dulled, discolored, or depraved; his aspirations flag; his hope, love, faith, reel. Impair them still more, and he becomes a brute. A cup of drink degrades his moral nature below that of a swine. Again, a violent emotion of pity or horror makes him vomit. A lancet will restore him from delirium to clear thought. Excess of thought will waste his sinews. Excess of muscular exercise will deaden thought. An emotion will double the strength of his muscles. And at last the prick of a needle or a grain of mineral will in an instant lay to rest forever his body and its unity, and all the spontaneous activities of intelligence, feeling, and action, with which that compound organism was charged.

"These are the obvious and ancient observations about the human organism. But modern philosophy and science have carried these hints into complete explanations. By a vast accumulation of proof positive, thought at last has established a distinct correspondence between every process of thought or of feeling and some corporeal phenomenon."

I cry with Shylock:

"'Tis very true, O wise and upright judge."

But, if the establishment of the correspondence between physical phenomena on the one side, and moral and intellectual phenomena on the other, is properly to be called an *explanation* (let alone a *complete explanation*) of the human organism, surely Mr. Harrison's teachings come dangerously near that tender of physical theories in explanation of moral phenomena which he warns us leads straight to corruption.

But perhaps I have misinterpreted Mr. Harrison. For a few lines further on we are told, with due italic emphasis, that "no man can *explain* volition by purely anatomical study."[1] I should have thought that Mr. Harrison might have gone much further than this. No man ever explained any physiological fact by purely anatomical study. Digestion cannot be so explained, nor respiration, nor reflex action. It would have been as relevant to affirm that volition could not be explained by measuring an arc of the meridian.

I am obliged to note the fact that Mr. Harrison's biological studies have not proceeded so far as to enable him to discriminate between the province of anatomy and that of physiology, because it furnishes the key to an otherwise mysterious utterance which occurs at page 631:

"A man whose whole thoughts are absorbed in cutting up dead monkeys and live frogs has no more business to dogmatize about religion than a mere chemist to improvise a zoölogy."

Quis negavit? But if, as, on Mr. Harrison's own showing, is the case, the progress of science (not anatomical, but physiological) has "established a distinct correspondence between every process of thought or of feeling and some corporeal phenomenon," and if it is true that "impaired secretions" deprave the moral sense, and make "hope, love, and faith reel," surely the religious feelings are brought within the range of physiological inquiry. If impaired secretions deprave the moral sense, it becomes an interesting and important problem to ascertain what diseased viscus may have been responsible for the *priest in absolution;* and what condition of the gray pulp may have conferred on it such a pathological steadiness of faith as to create the hope of personal immortality, which Mr. Harrison stigmatizes as so selfishly immoral.

I should not like to undertake the responsibility of advising anybody to dogmatize about anything; but surely if, as Mr. Harrison so strongly urges,[1] "the whole range of man's powers, from the finest spiritual sensibility down to a mere automatic contraction, falls into one coherent scheme, being all the multiform functions of a living organism in presence of its encircling conditions," then the man who endeavors to ascertain the exact nature of these functions, and to determine the influence of conditions upon them, is more likely to be in a position to tell us something worth hearing about them than one who is turned from such study by cheap pulpit thunder touching the presumption of "biological reasoning about spiritual things."

Mr. Harrison, as we have seen, is not quite so clear as is desirable respecting the limits of the

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provinces of anatomy and physiology. Perhaps he will permit me to inform him that physiology is the science which treats of the functions of the living organism, ascertains their coördinations and their correlations in the general chain of causes and effects, and traces out their dependence upon the physical states of the organs by which these functions are exercised. The explanation of a physiological function is the demonstration of the connection of that function with the molecular state of the organ which exerts the function. Thus the function of motion is explained when the movements of the living body are found to have certain molecular changes for their invariable antecedents; the function of sensation is explained when the molecular changes, which are the invariable antecedents of sensations, are discovered.

The fact that it is impossible to comprehend how it is that a physical state gives rise to a mental state no more lessens the value of the explanation in the latter case than the fact that it is utterly impossible to comprehend how motion is communicated from one body to another weakens the force of the explanation of the motion of one billiard-ball by showing that another has hit it.

The finest spiritual sensibility, says Mr. Harrison (and I think that there is a fair presumption that he is right), is a function of a living organism—is in relation with molecular facts. In that case, the physiologist may reply: "It is my business to find out what these molecular facts are, and whether the relation between them and the said spiritual sensibility is one of antecedence in the molecular fact, and sequence in the spiritual fact, or *vice versa*. If the latter result comes out of my inquiries, I shall have made a contribution toward a moral theory of physical phenomena; if the former, I shall have done somewhat toward building up a physical theory of moral phenomena. But in any case I am not outstepping the limits of my proper province: my business is to get at the truth respecting such questions at all risks; and if you tell me that one of these two results is a corrupting doctrine, I can only say that I perceive the intended reproach conveyed by the observation, but that I fail to recognize its relevance. If the doctrine is true, its social septic or antiseptic properties are not my affair. My business as a biologist is with physiology, not with morals."

This plea of justification strikes me as complete; whence, then, the following outbreak of angry eloquence?—

"The arrogant attempt to dispose of the deepest moral truths of human nature on a bare physical or physiological basis is almost enough to justify the insurrection of some impatient theologians against science itself."[1]

"That strain again: it has a dying fall;" nowise similar to the sweet south upon a bank of violets, however, but like the death-wail of innumerable "impatient theologians" as from the high "drum ecclesiastic" they view the waters of science flooding the Church on all hands. The beadles have long been washed away; escape by pulpit-stairs is even becoming doubtful, without kirtling those outward investments which distinguish the priest from the man so high that no one will see that there is anything but the man left. But Mr. Harrison is not an impatient theologian—indeed, no theologian at all, unless, as he speaks of "soul" when he means certain bodily functions, and of "future life" when he means personal annihilation, he may make his master's *grand être suprême* the subject of a theology; and one stumbles upon this well-worn fragment of too familiar declamation among his vigorous periods with the unpleasant surprise of one who finds a fly in a precious ointment.

There are people from whom one does not expect well-founded statement and thoughtful, however keen, argumentation, embodied in precise language. From Mr. Harrison one does. But I think he will be at a loss to answer the question, if I pray him to tell me of any representative of physical science who, either arrogantly or otherwise, has ever attempted to dispose of moral truths on a physical or physiological basis. If I am to take the sense of the words literally, I shall not dispute the arrogance of the attempt to dispose of a moral truth on a bare, or even on a covered, physical or physiological basis; for, whether the truth is deep or shallow, I cannot conceive how the feat is to be performed. Columbus's difficulty with the egg is as nothing to it. But I suppose what is meant is, that some arrogant people have tried to upset morality by the help of physics and physiology. I am sorry if such people exist, because I shall have to be much ruder to them than Mr. Harrison is. I should not call them arrogant, any more than I should apply that epithet to a person who attempted to upset Euclid by the help of the Rig-Veda. Accuracy might be satisfied, if not propriety, by calling such a person a fool; but it appears to me that it would be the height of injustice to term him arrogant.

[1] P. 242.

Whatever else they may be, the laws of morality, under their scientific aspect, are generalizations based upon the observed phenomena of society; and, whatever may be the nature of moral approbation and disapprobation, these feelings are, as a matter of experience, associated with certain acts.

The consequences of men's actions will remain the same, however far our analysis of the causes which lead to them may be pushed; theft and murder would be none the less objectionable if it were possible to prove that they were the result of the activity of special theft and murder cells in that "gray pulp" of which Mr. Harrison speaks so scornfully. Does any sane man imagine that any quantity of physiological analysis will lead people to think breaking their legs or putting their hands into the fire desirable? And when men really believe that breaches of the moral law involve their penalties as surely as do breaches of the physical law, is it to be supposed that even the very firmest disposal of their moral truths upon "a bare physical or physiological basis" will tempt them to incur those penalties?

I would gladly learn from Mr. Harrison where, in the course of his studies, he has found anything inconsistent with what I have just said in the writings of physicists or biologists. I would entreat him to tell us who are the true materialists, "the scientific specialists" who "neglect all philosophical and religious synthesis," and who "submit religion to the test of the scalpel or the electric battery;" where the materialism which is "marked by the ignoring of religion, the passing by on the other side and shutting the eyes to the spiritual history of mankind," is to be found.

I will not believe that these phrases are meant to apply to any scientific men of whom I have cognizance, or to any recognized system of scientific thought—they would be too absurdly inappropriate—and I cannot believe that Mr. Harrison indulges in empty rhetoric. But I am disposed to think that they would not have been used at all, except for that deep-seated sympathy with the "impatient theologian" which characterizes the positivist school, and crops out, characteristically enough, in more than one part of Mr. Harrison's essay.

Mr. Harrison tells us that "positivism is prepared to meet the theologians."[1] I agree with him, though not exactly in his sense of the words—indeed, I have formerly expressed the opinion that the meeting took place long ago, and that the faithful lovers, impelled by the instinct of a true affinity of nature, have met to part no more. Ecclesiastical to the core from the beginning, positivism is now exemplifying the law that the outward garment adjusts itself, sooner or later, to the inward man. From its founder onward, stricken with metaphysical incompetence, and equally incapable of appreciating the true spirit of scientific method, it is now essaying to cover the nakedness of its philosophical materialism with the rags of a spiritualistic phraseology out of which the original sense has wholly departed. I understand and I respect the meaning of the word "soul," as used by pagan and Christian philosophers for what they believe to be the imperishable seat of human personality, bearing throughout eternity its burden of woe, or its capacity for adoration and love. I confess that my dull moral sense does not enable me to see anything base or selfish in the desire for a future life among the spirits of the just made perfect; or even among a few such poor fallible souls as one has known here below.

And if I am not satisfied with the evidence that is offered me that such a soul and such a future life exist, I am content to take what is to be had and to make the best of the brief span of existence that is within my reach, without reviling those whose faith is more robust and whose hopes are richer and fuller. But in the interests of scientific clearness, I object to say that I have a soul, when I mean, all the while, that my organism has certain mental functions which, like the rest, are dependent upon its molecular composition, and come to an end when I die; and I object still more to affirm that I look to a future life, when all that I mean is, that the influence of my sayings and doings will be more or less felt by a number of people after the physical components of that organism are scattered to the four winds.

Throw a stone into the sea, and there is a sense in which it is true that the wavelets which spread around it have an effect through all space and all time. Shall we say that the stone has a future life?

It is not worth while to have broken away, not without pain and grief, from beliefs which, true or false, embody great and fruitful conceptions, to fall back into the arms of a half-breed between science and theology, endowed, like most half-breeds, with the faults of both parents and the virtues of neither. And it is unwise by such a lapse to expose one's self to the temptation of holding with the hare and hunting with the hounds—of using the weapons of one progenitor

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to damage the other. I cannot but think that the members of the positivist school in this country stand in some danger of falling into that fatal error; and I put it to them to consider whether it is either consistent or becoming for those who hold that "the finest spiritual sensibility" is a mere bodily function, to join in the view-halloo, when the hunt is up against biological science—to use their voices in swelling the senseless cry that "civilization is in danger if the workings of the human spirit are to become questions of physiology."

LORD BLACHFORD.—Mr. Harrison is of opinion that the difference between Christians and himself on this question of the soul and the future life "turns altogether on habits of thought." What appears to the positivist flimsy will, he says, seems to the Christian sublime, and *vice versa*, "simply because our minds have been trained in different logical methods," and this apparently because positivism "pretends to no other basis than positive knowledge and scientific logic." But if this is so, it is not, I think, quite consistent to conclude, as he does, that "it is idle to dispute about our respective logical methods, or to put this or that habit of mind in a combat with that." As to the combatants this may be true. But it surely is not idle, but very much to the purpose, for the information of those judges to whom the very act of publication appeals, to discuss habits and methods on which, it is declared, the difference altogether turns.

I note, therefore, *in limine* what, as I go on, I shall have occasion to illustrate, one or two differences between the methods of Mr. Harrison and those in which I have been trained.

I have been taught to consider that certain words or ideas represent what are called by logicians substances, by Mr. Harrison, I think, entities, and by others, as the case may be, persons, beings, objects, or articles. Such are air, earth, men, horses, chairs, and tables. Their peculiarity is that they have each of them a separate, independent, substantive existence. They *are*.

There are other words or ideas which do not represent existing things, but qualities, relations, consequences, processes, or occurrences, like victory, virtue, life, order, or destruction, which do but belong to substances, or result from them without any distinct existence of their own. A thing signified by a word of the former class cannot possibly be identical or even homogeneous with a thing signified by a word of the second class. A fiddle is not only a different thing from a tune, but it belongs to another and totally distinct order of ideas. To this distinction the English mind at some period of its history must have been imperfectly alive. If a Greek confounded κτίσις with κτίσμα, an act with a thing, it was the fault of the individual. But the English language, instead of precluding such a confusion, almost, one would say, labors to propagagate it. Such words as "building," "announcement," "preparation," or "power," are equally available to signify either the act of construction or an edifice—either the act of proclaiming or a placard—either the act of preparing or a surgical specimen—either the ability to do something or the being in which that ability resides. Such imperfections of language infuse themselves into thought. And I venture to think that the slight superciliousness with which Mr. Harrison treats the doctrines which such persons as myself entertain respecting the soul is in some degree due to the fact that positive "habits of thought" and "logical methods" do not recognize so completely as ours the distinction which I have described as that between a fiddle and a tune.

Again, my own habit of mind is to distinguish more pointedly than Mr. Harrison does between a unit and a complex whole. When I speak of an act of individual will, I seem to myself to speak of an indivisible act proceeding from a single being. The unity is not merely in my mode of representation, but in the thing signified. If I speak of an act of the national will—say a determination to declare war—I speak of the concurrence of a number of individual wills, each acting for itself, and under an infinite variety of influences, but so related to each other and so acting in concert that it is convenient to represent them under the aggregate term "nation." I use a term which signifies unity of being, but I really mean nothing more than coöperation, or correlated action and feeling. So, when I speak of the happiness of humanity, I mean nothing whatever but a number of particular happinesses of individual persons. Humanity is not a unit, but a word which enables me to bring a number of units under view at once. In the case of material objects, I apprehend, unity is simply relative and artificial—a grain of corn is a unit relatively to a bushel and an aggregate relatively to an atom. But I, believing myself to be a spiritual being, call myself actually and without metaphor—one.

Mr. Harrison, who acknowledges the existence of no being but matter, appears either to deny the existence of any real unity whatever, or

to ascribe that real unity to an aggregate of things or beings who resemble each other, like the members of the human race, or coöperate toward a common result, like the parts of a picture, a melody, or the human frame, and which may thus be conveniently viewed in combination, and represented by a single word or phrase.

I think that the little which I have to say will be the clearer for these preliminary protests.

The questions in hand relate first to the claim of the soul of man to be treated as an existing thing not bound by the laws of matter; secondly, to the immortality of that existing thing.

The claim of the soul to be considered as an existing and immaterial being presents itself to my mind as follows:

My positive experience informs me of one thing percipient—myself; and of a multitude of things perceptible—perceptible, that is, not by way of consciousness, as I am to myself, but by way of impression on other things—capable of making themselves felt through the channels and organs of sensation. These things thus perceptible constitute the material world.

I take no account of percipients other than myself, for I can only conjecture about them what I know about myself. I take no account of things neither percipient nor perceptible, for it is impossible to do so. I know of nothing outside me of which I can say it is at once percipient and perceptible. But I inquire whether I am myself so—whether the existing being to which my sense of identity refers, in which my sensations reside, and which for these two reasons I call "myself," is capable also of being perceived by beings outside myself, as the material world is perceived by me.

I first observe that things perceptible comprise not only objects, but instruments and media of perception—an immense variety of contrivances, natural or artificial, for transmitting information to the sensitive being. Such are telescopes, microscopes, ear-trumpets, the atmosphere, and various other media which, if not at present the objects of direct sensation, may conceivably become so—and such, above all, are various parts of the human body—the lenses which collect the vibrations which are the conditions of light; the tympanum which collects the vibrations which are the conditions of sound; the muscles which adjust these and other instruments of sensation to the precise performance of their work; the nerves which convey to and fro molecular movements of the most incomprehensible significance and efficacy. Of all these it is, I understand, more and more evident, as science advances, that they are perceptible, but do not perceive. Ear, hand, eye, and nerves, are alike machinery—mere machinery for transmitting the movement of atoms to certain nervous centres—ascertained localities which (it is proper to observe in passing), though small relatively to ourselves and our powers of investigation, may—since size is entirely relative—be *absolutely* large enough to contain little worlds in themselves.

Here the investigation of things perceptible is stopped, abruptly and completely. Our inquiries into the size, composition, and movement of particles, have been pushed, for the present at any rate, as far as they will go. But at this point we come across a field of phenomena to which the attributes of atoms, size, movement, and physical composition, are wholly inapplicable—the phenomena of sensation or animal life.

Science informs me that the movements of these perceptible atoms within my body bear a correspondence, strange, subtile, and precise, to the sensations of which I, as a percipient, am conscious; a correspondence (it is again proper to observe in passing) which extends not only to perceptions, as in sight or hearing, but to reflection and volition, as in sleep and drunkenness. The relation is not one of similarity. The vibrations of a white, black, or gray pulp are not in any sensible way similar to the perception of color or sound, or the imagination of a noble act. There is no visible—may I not say no conceivable?—reason why one should depend on the other. Motion and sensation interact, but they do not overlap. There is no homogeneity between them. They stand apart. Physical science conducts us to the brink of the chasm which separates them, and by so doing only shows us its depth.

I return then to the question, "What am I?" My own habits of mind and logical methods certainly require me to believe that I am something—something percipient—but am I perceptible? I find no reason for supposing it. I believe myself to be surrounded by things percipient. Are they perceptible? Not to my knowledge. Their existence is to me a matter of inference from their perceptible appendages. Them—their very selves—I certainly cannot perceive. As far as I can understand things perceptible, I detect in them no quality—no capacity for any quality like that of percipiency, which, with its homogeneous faculties, intellect, affections, and so on, is the basis of my own nature. Physical science, while it develops the relation, seems absolutely to emphasize and illuminate the ineradicable difference between the motions of a material and the sensa-

tions of a living being. Of the attributes of a percipient we have, each for himself, profound and immediate experience. Of the attributes of the perceptible we have, I suppose, distint scientific conceptions. Our notions of the one and our notions of the other appear to attach to a different order of being.

It appears therefore to me that there is no reason to believe, and much reason for not believing, that the percipient is perceptible under our present conditions of existence, or indeed under any conditions that our present faculties enable us to imagine.

And this is my case, which of course covers the whole animal creation. Perception must be an attribute of something, and there is reason for believing that this something is imperceptible. This is what I mean when I say that I have, or more properly that I am, a soul or spirit, or rather it is the point on which I join issue with those who say that I am not.

I am not, as Mr. Harrison seems to suppose, running about in search of a "cause." I am inquiring into the nature of a being, and that being myself. I am sure I am something. I am certainly not the mere tangible structure of atoms which I affect, and by which I am affected after a wonderful fashion. In reflecting on the nature of my own operations I find nothing to suggest that my own being is subject to the same class of physical laws as the objects from which my sensations are derived, and I conclude that I am not subject to those laws. The most substantial objection to this conclusion is conveyed, I conceive, in a sentence of Mr. Harrison's: "To talk to us of mind, feeling, and will, continuing their functions in the absence of physical organs and visible organisms, is to use language which, to us at least, is pure nonsense."

It is probably to those who talk thus that Mr. Harrison refers when he says that argument is useless. And in point of fact I have no answer but to call his notions anthropomorphic, and to charge him with want of a certain kind of imagination. By imagination we commonly mean the creative faculty which enables a man to give a palpable shape to what he believes or thinks possible; and this, I do not doubt, Mr. Harrison possesses in a high degree. But there is another kind of imagination which enables a man to embrace the idea of a possibility to which no such palpable shape can be given, or rather of a world of possibilities beyond the range of his experience or the grasp of his faculties; as Mr. John Mill embraced the idea of a possible world in which the connection of cause and effect should not exist. The want of this necessary though dangerous faculty makes a man the victim of vivid impressions, and disables him from believing what his impressions do not enable him to realize. Questions respecting metaphysical possibility turn much on the presence, or absence, or exaggeration, of this kind of imagination. And when one man has said, "I can perceive it possible," and another has said, "I cannot," it is certainly difficult to get any further.

To me it is not in the slightest degree difficult to conceive the possible existence of a being capable of love and knowledge without the physical organs through which human beings derive their knowledge, nor in supposing myself to be such a being. Indeed, I seem actually to exercise such a capacity (however I got it) when I shut my eyes and try to think out a moral or mathematical puzzle. If it is true that a particular corner of my brain is concerned in the matter, I accept the fact not as a self-evident truth (which would seem to be Mr. Harrison's position), but as a curious discovery of the anatomists. But having said this I have said everything, and, as Mr. Harrison must suppose that I deceive myself, so I suppose that in his case the imagination which founds itself on experience is so active and vivid as to cloud or dwarf the imagination which proceeds beyond or beside experience.

Mr. Harrison's own theory I do not quite understand. He derides the idea, though he does not absolutely deny the possibility, of an immaterial entity which feels. And he appears to be sensible of the difficulty of supposing that atoms of matter which assume the form of a gray pulp can feel. He holds accordingly, as I understand, that feeling, and all that follows from it, are the results of an "organism."

If he had used the word "organization," I should have concluded unhesitatingly that he was the victim of the Anglican confusion which I have above noticed, and that, in his own mind, he escaped the alternative difficulties of the case by the common expedient of shifting, as occasion required, from one sense of that word to the other. If pressed by the difficulty of imagining sensation not resident in any specific sensitive thing, the word organization would supply to his mind the idea of a thing, a sensitive aggregate of organized atoms. If, on the contrary, pressed by the difficulty of supposing that these atoms, one or all, thought, the word would shift its meaning and present the aspect not of an aggregate bulk, but of orderly arrangement—not of a

thing, or collection of things, but of a state of things.

But the word "organism" is generally taken to indicate a thing organized. And the choice of that word would seem to indicate that he ascribed the spiritual acts (so to call them) which constitute life to the aggregate bulk of the atoms organized, or the appropriate part of them. But this he elsewhere seems to disclaim. "The philosophy which treats man as man simply affirms that *man* loves, thinks, acts, not that ganglia, or the sinews, or any organ of man loves, and thinks, and acts." Yes, but we recur to the question, "What is man?" If the ganglia do not think, what is it that does? Mr. Harrison, as I understand, answers that it is a *consensus* of faculties, an harmonious system of parts, and he denounces an attempt to introduce into this collocation of parts or faculties an underlying entity or being which shall possess those faculties or employ those parts. It is then not after all to a being or aggregate of beings, but to a relation or condition of beings, that will and thought and love belong. If this is Mr. Harrison's meaning, I certainly agree with him that it is indeed impossible to compose a difference between two disputants of whom one holds, and the other denies, that a condition can think. If my opponent does not admit this to be an absurdity, I do not pretend to drive him any further.

With regard to immortality, I have nothing material to add to what has been said by those who have preceded me. I agree with Prof. Huxley that the natural world supplies nothing which can be called evidence of a future life. Believing in God, I see in the constitution of the world which he has made, and in the yearnings and aspirations of that spiritual nature which he has given to man, much that commends to my belief the revelation of a future life which I believe him to have made. But it is in virtue of his clear promise, not in virtue of these doubtful intimations, that I rely on the prospect of a future life. Believing that he is the author of that moral insight which in its ruder forms controls the multitude, and in its higher inspires the saint, I revere those great men who were able to forecast this great announcement, but I cannot and do not care to reduce that forecast to any logical process, or base it on any conclusive reasoning. Rather I admire their power of divination the more on account of the narrowness of their logical data. For myself, I believe because I am told.

But whether the doctrine of immortality be true or false, I protest, with Mr. Hutton, against the attempt to substitute for what, at any rate, is a substantial idea, something which can hardly be called even a shadow or echo of it.

The Christian conception of the world is this: It is a world of moral as of physical waste. Much seed is sown which will not ripen, but some is sown that will. This planet is a seat, among other things, of present goodness and happiness. And this our goodness and happiness, like our crime and misery, propagate or fail to propagate themselves during our lives and after our deaths. But, apart from these earthly consequences, which are much to us and all to the positivist, the little fragment of the universe on which we appear and disappear is, we believe, a nursery for something greater. The capacities for love and knowledge, which in some of us attain a certain development here, we must all feel to be capable, with greater opportunities, of an infinitely greater development; and Christians believe that such a development is in fact reserved for those who, in this short time of apprenticeship, take the proper steps for approaching it.

This conception of a glorious and increasing company, into which the best of men are continually to be gathered to be associated with each other (to say no more) in all that can make existence happy and noble, may be a dream, and Mr. Harrison may be right in calling it so. In deriding it he cannot be right. "The eternity of the tabor" he calls it! Has he never felt, or, at any rate, is he not able to conceive, a thrill of pleasure at a sympathetic interchange of look, or word, or touch, with a fellow-creature kind and noble and brilliant, and engaged in the exhibition of those qualities of heart and intellect which make him what he is? Multiply and sustain this—suppose yourself surrounded by beings with whom this interchange of sympathy is warm and perpetual. Intensify it. Increase indefinitely the excellence of one of those beings, the wonderful and attractive character of his operations, our own capacities of affection and intellect, the vividness of our conception, the breadth and firmness of our mental grasp, the sharp vigor of our admiration; and, to exclude satiety, imagine if you like that the operations which we contemplate and our relations to our companions are infinitely varied—a supposition for which the size of the known and unknown universe affords indefinite scope—or otherwise suppose that sameness ceases to tire, as the old Greek philosopher thought it might do if we we were better than we

are (μεταβολὴ πάντων γλυκύτατον διὰ πονηρίαν τινά), or as it would do, I suppose, if we had no memory of the immediate past. Imagine all this as the very least that may be hoped, if our own powers of conception are as slight in respect to the nature of what is to be as our bodies are in relation to the physical universe. And remember that, if practical duties are necessary for the perfection of life, the universe is not so small but that in some corner of it its Creator might always find something to do for the army of intelligences whom he has thus formed and exalted.

All this, I repeat, may be a dream, but to characterize it as "the eternity of the tabor" shows surely a feebleness of conception or carelessness of representation more worthy of a ready writer than of a serious thinker. And to place before us as a rival conception the fact that some of our good deeds will have indefinite consequences—to call this scanty and fading chain of effects, which we shall be as unable to perceive or control as we have been unable to anticipate—to call this a "posthumous activity," "an eternity of spiritual influence," and a "life beyond the grave," and finally, under the appellation of "incorporation into the glorious future of our race," to claim for it a dignity and value parallel to that which would attach to the Christian's expectation (if solid) of a sensible life of exalted happiness for himself and all good men, is surely nothing more or less than extravagance founded on misnomer.

With regard to the promised incorporation, I should really like to know what is the exact process, or event, or condition, which Mr. Harrison considers himself to understand by the incorporation of a *consensus* of faculties with a glorious future; and whether he arrived at its apprehension by way of "positive knowledge," or by way of "scientific logic."

Mr. Harrison's future life is disposed of by Prof. Huxley in a few words: "Throw a stone into the sea, and there is a sense in which it is true that the wavelets which spread around it have an effect through all space and time. Shall we say that the stone has a future life?"

To this I only add the question whether I am not justified in saying that Mr. Harrison does not adequately distinguish between the nature of a fiddle and the nature of a tune, and would contend (if consistent) that a violin which had been burned to ashes would, notwithstanding, continue to exist, at least as long as a tune which had been played upon it survived in the memory of any one who had heard it—the *consensus* of its capacities being, it would seem, incorporated into the glorious future of music.

Hon. RODEN NOEL.—Death is a phenomenon; but are we phenomena?

The question of immortality seems, philosophically speaking, very much to resolve itself into that of personality. Are we persons, spirits, or are we things? Perhaps we are a loose collection of successive qualities? That seems to be the latest conclusion of positive and Agnostic biological philosophy. The happy thought which, as Dr. Stirling suggests, was probably thrown out in a spirit of persiflage by Hume has been adopted in all seriousness by his followers. Mr. Harrison is very bitter with those who want to explain mental and moral phenomena by physiology. But, as Prof. Huxley remarks, he seems in many parts of his essay to do the same thing himself. What could Büchner, or Carl Vogt, say stronger than this? "At last, the prick of a needle, or a grain of mineral, will in an instant lay to rest forever man's body and its unity, and all the spontaneous activities of intelligence, feeling, and action, *with which that compound organism was charged*" (No. III., p. 239). Again, he says, the spiritual faculties are "directly dependent on physical organs"—"stand forth as functions of living organs in given conditions of the organism." Again: "At last the man Newton dies, that is, the body is dispersed into gas and dust" (No. IV., p. 311). Mr. Harrison, then, though a positivist, bound to know only successive phenomena, seems to know the body as a material entity possessed of such functions as conscience, reason, imagination, perception—to know that Newton's body thought out the "Principia," and Shakespeare's conceived "Hamlet." Indeed, Agnosticism generally, though with a show of humility, seems rather arbitrary in its selection of what we shall know, and what we shall not; we must know something; so we shall know that we have ideas and feelings, but not the personal identity that alone makes them intelligible, or we shall use the word, and yet speak as if the idea were a figment; we shall know qualities, but not substance; "functions" and "forces," but not the some one or something of which they must be functions and forces to be conceivable at all. Yet *naturam expellas furca*, etc. Common-sense insists on retaining the fundamental laws of human thought, not being able to get rid of them; and hence the hap-hazard, instead of systematic and orderly, fashion in which the new philosophy deals with universal convictions, denying even that they exist out of theology and *métaphysique*.

Thus (in apparent contradiction to the statements quoted), on p. 242, No. III., we are told that it is "man who loves, thinks, acts; not the ganglia, or sinuses, or any organ" that does so. But perhaps the essayist means that all the body together does so. He says a man is "the consensus, or combined activity of his faculties." What is meant by this phraseology? It is just this "*his*," this "*consensus*," or "*combined* acting," that is inconceivable without the focus of unity, in which many contemporaneous phenomena, and many past and present, meet to be compared, remembered, identified, as belonging to the same self; so only can they be known phenomena at all. Well, do we find in examining the physical structure of man's body as solid, heavy, extended, divisible, or its living organs and their physical functions, or the rearrangement of molecules of carbon, nitrogen, hydrogen, etc., into living tissue, or its oxidation, anything corresponding to the consciousness of personal moral agency, and personal identity? We put the two classes of conception side by side, and they seem to refuse to be identified—man as one and the same conscious moral agent—and his body, or the bumps on his skull; or is man indeed a function of his own body? Are we right in talking of our bodies as material things, and of ourselves as if we were not things, but persons with mights, rights, and duties? We ought, perhaps, to talk—theologies and philosophies being now exploded—not of our having bodies, but of bodies having us, and of bodies having rights or duties. Perhaps Dundreary was mistaken, and the tail may wag the dog after all.

Mr. Harrison says: "Orthodoxy has so long been accustomed to take itself for granted, that we are apt to forget how very short a period of human history this sublimated essence" (the immaterial soul) "has been current. There is not a trace of it in the Bible in its present sense." This reminds one rather of Mr. Matthew Arnold's contention that the Jews did not believe in God. But really it does not much signify what particular intellectual theories have been entertained by different men at different times about the nature of God or of the soul: the question is whether you do not find on the whole among them all a consciousness or conviction that there is a Higher Being above them, together with a power of distinguishing themselves from their own bodies, and the world around them—in consequence of this, too, a belief in personal immortality. Many in all ages believe that the dead have spoken to us from beyond the grave. But into that I will not enter. *Are we our bodies?* that seems to be the point. Now, I do not think positivism has any right to assume that we are, even on its own principles and professions.

Mr. Harrison (No. III., p. 239) has a very forcible passage, in which he enlarges upon this theme: that "the laws of the separate functions of body, mind, or feeling, have visible relations to each other; are inextricably woven in with each other, act and react. . . . From the summit of spiritual life to the base of corporeal life, whether we pass up or down the gamut of human forces, there runs one organic correlation and sympathy of parts. Touch the smallest fibre in the corporeal man, and in some infinitesimal way we may watch the effect in the moral man. When we rouse chords of the most glorious ecstasy of the soul, we may see the vibrations of them visibly thrilling upon the skin." Here we are in the region of positive facts as specially made manifest by recent investigation. And the orthodox schools need to recognize the significance of such facts. The close interdependence of body and soul is a startling verity that must be looked in the face; and the discovery has, no doubt, gone far to shake the faith of many in human immortality, as well as in other momentous kindred truths. It has been so with myself. But I think the old dictum of Bacon about the effect of a little and more knowledge will be found applicable after all. Let us look these facts very steadily in the face. When we have thought for a long time, there is a feeling of pain in the head. That is a feeling, observe, in our own conscious selves. Further, by observation and experiment, it has been made certain that some molecular change in the nervous substance of the brain (to the renewal of which oxygenated blood is necessary) is going on, while the process of thinking takes place—though we are not conscious of it in our own case, except as a matter of inference. The thought itself seems, when we reflect on it, partly due to the action of an external world or cosmos upon us; partly to our own "forms of thought," or fixed ways of perceiving and thinking, which have been ours so long as we can remember, and which do not belong to us more than to other individual members of the human family; again partly to our own past experience. But what *is* this material process accompanying thought, which conceivably we might perceive if we could see the inside of our own bodies? Why it too can only seem what it seems by virtue of our own personal past experience, and our own human as

well as individual modes of conceiving. Is not that "positive" too? Will not men of science agree with me that such is the fact? In short, our bodies, on any view of them, *Science herself has taught us*, are *percepts and concepts of ours*—I don't say of the "soul," or the mind, or any *bête noire* of the sort, but of *ourselves*, who surely cannot be altogether *bêtes noires*. They are as much percepts and concepts of ours as is the material world outside them. Are they colored? Color, we are told, is a sensation. Are they hard or soft? These are our sensations, and relative to us. The elements of our food enter into relations we name living; their molecules enter into that condition of unstable equilibrium; there is motion of parts fulfilling definite intelligible and constant uses, in some cases subject to our own intelligent direction. But all this is what appears to our intelligence, and it appears different, according to the stages of intelligence at which we arrive; a good deal of it is hypothesis of our own minds. Readers of Berkeley and Kant need not be told this; it is now universally acknowledged by the competent. The atomic theory is a working hypothesis of our minds only. Space and time are relative to our intelligence, to the succession of our thoughts, to our own faculties of motion, motion being also a conception of ours. Our bodies, in fact, as positivists often tell us, and as we now venture to remind *them*, are *phenomena*, that is, *orderly appearances to us*. They further tell us generally that there is nothing which thus appears, or that we cannot know that there is anything beyond the appearance. What, then, according to positivism itself, is the most we are entitled to affirm with regard to the dead? Simply that there are *no appearances to us* of a living personality *in connection with* those phenomena which we call a dead body, any more than there are in connection with the used-up materials of burned tissues that pass by osmosis into the capillaries, and away by excretory ducts. But are we entitled to affirm that the *person* is extinct—is dissolved—the one conscious self in whom these bodily phenomena centred (except so far as they centred in us), who was the focus of them, gave them form, made them what they were; whose thoughts wandered up and down through eternity; of whom, therefore, the bodily as well as mental and spiritual functions were functions, so far as the body entered into the conscious self at all? We can, on the contrary, only affirm that probably the person no longer perceives, and is conscious, *in connection with this form* we look upon, wherein so-called chemical affinities now prevail altogether over so-called vital power. But even in life the body is always changing and decomposing—foreign substances are always becoming a new body, and the old body becoming a foreign substance. Yet the person remains one and the same. True, positivism tries to eliminate persons, and reduce all to appearances; but this is too glaring a violation of common-sense, and I do not think from his language Mr. Harrison quite means to do this. Well, by spirit, even by "soul," most people, let me assure him, only mean *our own conscious personal selves*. For myself, indeed, I believe that there cannot be appearances without something to appear. But seeing that the material world is in harmony with our intelligence, and presents all the appearance of intelligent coöperation of parts with a view to ends, I believe, with a great English thinker, whose loss we have to deplore (James Hinton), that all this is the manifestation of life—of living spirits or persons, not of dead, inert matter, though from our own spiritual deadness or inertness it appears to us material. Upon our own moral and spiritual life, in fact, depends the measure of our knowledge and perception. I can indeed admit with Mr. Harrison that probably there must always be to us the phenomenon, the body, the external; but it may be widely different from what it seems now. We may be made one with the great Elohim, or angels of Nature who create us, or we may still grovel in dead material bodily life. We now appear to ourselves and to others as bodily, as material. Body, and soul or mind, are two opposite phenomenal poles of one reality, which is self or spirit; but though these phenomena may vary, the creative, informing spirit, which underlies all, of which we partake, which is absolute, divine, this can never be destroyed. "In God we live, move, and have our being." It is held, indeed, by the new philosophy, that the temporal, the physical, and the composite (elements of matter and "feeling"), are the basis of our higher consciousness: on the contrary, I hold that this is absurd, and that the one eternal consciousness or spirit must be the basis of the physical, composite, and temporal; is needed to give unity and harmony to the body. One is a little ashamed of agreeing with an old-fashioned thinker, whom an old-fashioned poet pronounced the "first of those who know," that the spirit is organizing vital principle of the body, not *vice versa*. The great difficulty, no doubt, is that apparent irruption of the external into the personal, when, as the essayist says, "impair a man's secretions,

and moral sense is dulled, discolored, depraved." But it is our spiritual deadness that has put us into this physical condition; and probably it is *we* who are responsible in a fuller sense than we can realize now for this effect upon us, which must be in the end too for purposes of discipline; it belongs to our spiritual history and purpose. Moreover, this external world is not so foreign to us as we imagine; it is spiritual, and between all spirit there is solidarity.

Mr. Hinton observes (and here I agree with him rather than with Mr. Harrison) that the defect and falseness of our knowing must be in the knowing by only part of ourselves. Whereas sense had to be supplemented by intellect, and proved misleading without it, so intellect, even in the region of knowledge, has to be supplemented by moral sense, which is the highest faculty in us. We are at present misled by a false view of the world, based on sense and intellect only. Death is but a hideous illusion of our deadness—

> "Death is the veil which those who live call life:
> We sleep, and it is lifted."

The true definition of the actual is that which is true for, which satisfies the whole being of humanity. We must ask of a doctrine, "Does it answer in the moral region?" if so, it is as true as we can have it with our present knowledge; but, if the moral experiment fails, it is not true. Conscience has the highest authority about knowledge, as it has about conduct. Now apply this to the negations of positivism, and the belief Comte would substitute for faith in God, and personal immortality. Kant sufficiently proved that these are postulates required by Practical Reason, and on this ground he believed them. I am not blind to the beauty and nobleness of Comte's moral ideal (not without debt to Christ's) as expounded by himself, and here by Mr. Harrison. Still I say, The moral experiment fails. Some of us may seek to benefit the world, and then desire rest. But what of the maimed and broken and aimless lives around us? What of those we have lost, who were dearer to us than our own selves, full of fairest hope and promise, unaware annihilated in earliest dawn, whose dewy bud yet slept unfolded? If they were *things*, doubtless we *might* count them as so much manure, in which to grow those still more beautiful though still brief-flowering human aloes, which positivism, though knowing nothing but present phenomena, and denying God, is able confidently to promise us in some remote future. But alas! they *seemed* living spirits, able to hope for infinite love, progressive virtue, the beatific vision of God himself! And they really *were*—so much manure! Why, as has already been asked, are such ephemerals worth living for, however many of them there may be, whose lives are as an idle flash in the pan, always promising, yet failing to attain any substantial or enduring good? What of these agonizing women and children, now the victims of Ottoman blood-madness? What of all the cramped, unlovely, debased, or slow-tortured yet evanescent lives of myriads in our great cities? These cannot have the philosophic aspirations of culture. They have too often none at all. Go proclaim to them this gospel, supplementing it by the warning that in the end there will remain only a huge block of ice in a "wide, gray, lampless, deep, unpeopled world!" I could believe in the pessimism of Schopenhauer, not in this jaunty optimism of Comte.

Are we then indeed orphans? Will the tyrant go ever unpunished, the wrong ever unredressed, the poor and helpless remain always trampled and unhappy? Must the battle of good and evil in ourselves and others hang always trembling in the balance, forever undecided; or does it all mean nothing more than we see now, and is the glorious world but some ghastly illusion of insanity? When "the fever called living is over at last," is all indeed over? Thank God that through this Babel of discordant voices modern men can still hear his accents who said, "Come unto me, all ye that are weary and heavy laden, and I will give you rest."

—*Nineteenth Century.*

THE SCRIPTURE DOCTRINE OF ANGELS.[1]

By Professor W. ROBERTSON SMITH, of the University of Aberdeen.

ANGEL is a transcription of the Greek ἄγγελος, *a messenger*, but in signification corresponds to the special theological sense which the latter word assumed among the Hellenistic Jews (and hence in the New Testament and in Christian writings), by being adopted as the translation of the Hebrew *Mal'akh*. Thus both name and notion of angel go back to the Old Testament.

The Old Testament belief in angels has two sides, being, on the one hand, a particular development of the belief in special manifestations of God to man; and on the other hand, a belief in the existence of superhuman beings standing in a peculiar relation of nearness to God. These two sides of the doctrine are historically associated, and coöperate in the later developments of Biblical angelology, but are not in all parts of the Old Testament fused into perfect unity of thought.

The first side of the belief in angels is expressed in the word *Mal'akh*, a messenger or embassador; more fully, *messenger of Jehovah* [English version, angel of the Lord], *messenger of God*. The whole Old Testament revelation moves in the paradox that God is invisible and inaccessible to man, and yet approaches man in unmistakable self-manifestation. This manifestation takes place in various ways, in the priestly oracle, in prophecy, in the glory of God within the sanctuary [shekhina]. But, in particular, the early history represents God as manifesting himself by his *messenger*. In special crises "the messenger of Jehovah" calls from heaven to Hagar, or to Abraham (Genesis xxi., xxii.). Or, if God seeks to commune more fully with a man, his messenger appears and speaks to him. The narratives of such angelophanies vary in detail. Generally there is but one angel, but Abraham is visited by three (Genesis xviii.). Sometimes the dignity of the heavenly visitor is detected while he is present; at other times he is mistaken for a prophet, and recognized only by something supernatural in his disappearance (Judges vi. 21, *sq.*, xiii. 20). Jacob wrestles all night with a "man" who at length with a touch dislocates his thigh (Genesis xxxii. 24, *sqq.*). At other times no human form is seen. It is the angel of Jehovah who speaks to Moses in the burning bush, and leads the Israelites in the pillar of cloud and smoke (Exodus iii. 2, xiv. 19).

In all this there is perfect indifference to the personality of the angel, who displays no individuality of character, refuses to give a name (Genesis xxxii.; Judges xiii.), acts simply as the mouth-piece of God. This is carried so far that in his mouth the pronoun *I* indicates Jehovah himself; while the narrative passes, without change of sense, from the statement, "the angel of Jehovah appeared, spoke," etc., to "Jehovah appeared, spoke." (Compare, for example, Exodus iii. verse 2 with verse 4; xiii. 21 with xiv. 19.) Those who see the angel say they have seen God (Judges xiii. 22; Genesis xxxii. 30). The angelophany is a theophany, as direct as is possible to man. The idea of a full representation of God to man, in all his revealed character, by means of an angel, comes out most clearly for the angel that leads Israel in the very old passage, Exodus xxiii. 20, *sqq.* This angel is sent before the people to keep them in the way, and bring them to Canaan. He speaks with divine authority, and enforces his commands by divine sanctions, "for my name [i. e., the compass of my revealed qualities] is in him." The question naturally arises, how the angel who possesses these high predicates stands related to angels who elsewhere appear, not representing the whole self-manifestation of God to his people, but discharging isolated commissions. The Biblical data for the solution of this question are very scanty. An essential distinction between the "angel of the Lord," who speaks in all things with full divine authority, and subordinate angels, is sought mainly in Genesis xviii. and in Exodus xxxii. 30, *sqq.*, xxxiii., compared with Isaiah lxiii. 9. In the former case, though two of the three angels leave Abraham, Jehovah goes his way only on the departure of the third. Yet the two angels, when they come to Lot, are apparently as direct a manifestation of God to him as the third was to Abraham (xix. 18, *sqq.*). And in the other passage it has not been clearly made out that there is really a distinction drawn between an

[1] This article, contributed to the "Encyclopædia Britannica" by Prof. Smith, was included with the article on the Bible in the indictment for heresy by the Free Church of Scotland.

angel who represents God's presence, and an angel of a lower kind who does not do so. The notion (long current in dogmatic theology, and which goes back to the earliest controversies between Jews and Christians) that "the angel of the Lord," as contradistinguished from created angels, is the Logos—the second person of the Trinity—has found defenders down to the present day (Hengstenberg, Keil, etc.), but certainly does not express the sense of the Old Testament writers. And it seems equally unprofitable to base on such passages as we have cited a controversy whether "the angel of Jehovah" is one special angel charged throughout history with special functions toward the covenant people, or is any angel who from time to time has a special commission, or is to be viewed, at least in some cases, not as a hypostatic being, but simply as a momentary sinking of the invisible God into the sphere of visibility. The *function* of the angel so entirely overshadows his *personality* that the Old Testament does not ask who or what this angel is, but what he does. And the answer to this last question is, that he represents God to man so directly and fully that, when he speaks or acts, God himself is felt to speak or act. The strongest passage perhaps is Genesis xlviii. 15, *sq.*

The disposition to look away from the personality of the angels, and concentrate attention on their ministry, runs more or less through the whole Old Testament angelology. It is indeed certain—to pass to the second side of the doctrine—that the angelic figures of the Bible narrative are not mere allegories of divine providence, but were regarded as possessing a certain superhuman reality. But this reality is matter of assumption rather than of direct teaching. Nowhere do we find a clear statement as to the creation of the angels [Genesis ii. 1 is ambiguous, and it is scarcely legitimate in Psalm cxlviii. to connect verse 2 with verse 5]. That they are endowed with special goodness and insight, analogous to human qualities, appears as a popular assumption, not as a doctrine of revelation (1 Samuel xxix. 9; 2 Samuel xiv. 17, xix. 27). Most characteristic for the nature of the angels is the poetic title "sons of God" (*Bnê Elohim*, or, with a slight modification, *Bnê Elim*, in English version incorrectly "mighty," "sons of the mighty," Psalm xxix. 1, lxxxix. 6), which, in accordance with the idiomatic force of the word *sons*, may be paraphrased, "Beings who in a subordinate way share something of divine majesty." Perhaps in Psalm lxxxii. the name Elohim itself varies with the more usual "sons of Elohim."

Taken collectively, the angels form the hosts of Jehovah (Psalm ciii. 21, etc.), or the host of heaven (1 Kings xxii. 19), names correlative to the new title of God, which springs up at the close of the period of the Judges, "Jehovah [God of] hosts." The notion of angels as divine armies is not like that of the individual "messenger" closely connected with the theophanic history (yet compare Genesis xxxii. 1, 2; Joshua v. 13, *sqq.*), but belongs rather to the delineation of the majesty of God in poetry and prophecy. As the whole conception of the heavenly palace and throne is obviously symbolical, we must allow for conscious poetic art when the angels are represented surrounding God's throne in the form of an *assembly* or *privy council* of holy ones (consecrated servants), praising his name, or receiving his commands, and reporting their execution (Psalms xxix., lxxxix. 6–8; 1 Kings xxii. 19, *sqq.*; Job i.). Similarly much must be allowed for the free play of fancy when in the last judgment against the enemies of his people Jehovah descends to battle with his *heroes* (Joel iv. 11), his *holy ones* (Zechariah xiv. 5), or when he triumphantly enters Zion amid myriads of heavenly war-chariots (Psalm lxviii. 17). Compare Isaiah lxvi. 15, Habakkuk iii., which show how closely such imagery is connected with the physical phenomena of the thunder-storm.

With the development of the idea of countless hosts of divine ministers is naturally associated, in place of the old angelic theophany, the conception of an invisible agency of angels, who are henceforth seen only in vision or to eyes specially opened (Numbers xxii. 31; 2 Kings vi. 17). To the guidance of Israel by the angel of Jehovah succeeds the belief in angelic guidance of individuals (Psalm xxxiv. 7), more or less poetically worked out (Psalm xci. 11). Conversely, pestilence and other judgments are angelic visitations (2 Samuel xxiv.; 2 Kings xix. 35; Psalm lxxviii. 49, where the "evil angels" of the English version are not wicked angels, but angels of evil). At length this is carried so far that all natural forces that serve God are viewed as his messengers—Psalm civ. 4: "He makes winds his messengers flaming fire his ministers." This passage clearly shows the elasticity of the whole conception. Similar is the way in which the stars, which share with the angels the name "host of heaven," appear associated with the latter (Job xxxviii. 7). Hence the later elemental angels.

Angelic interpretation between God and man reappears in Job xxxiii. 23 (*see* iv. 13, *sqq.*), and converse with angels forms a large part of the visionary setting of the later prophetical books (Ezekiel, Zechariah). But these visions, to which the prophets do not ascribe objective reality, illustrate rather the religious imagination than the theology of the period.

The idea of ranks and classes of angels, though naturally suggested by the conception of a host (*see* Joshua v. 13, *sqq.*), was up to this time undeveloped; for neither the purely symbolical cherubim, nor the unique and obscure seraphim of Isaiah vi., have in the Old Testament the meaning later conferred on them of distinct classes of angels. But the angels of Zechariah present something of a systematic scheme, though it seems unsafe, with Ewald and others, to see in the seven eyes of Jehovah (iii. 9, iv. 10) a developed doctrine of seven chief angels (as in Tobit xii. 15; Revelation viii. 2), parallel to and influenced by the *Amesha-çpentas* of the Eranian mythology. The book of Daniel shows a much fuller development in a similar line. Israel, Persia, etc., have special angels (princes), whose contests represent those of human history (chapters x., xii.; *see* Isaiah xxiv. 21, *sq.*). "The great prince who presides over" Israel is named Michael (who is like God?), and the *angelus interpres* is called Gabriel (man of God). The analogy of these notions to those of Zarathustrism is less decided than has often been supposed; but the freedom which Old Testament writers allow themselves in matters of imaginative representation, to which these conceptions mainly belong, is such as to render foreign influence quite credible.

The ranks, classes, and names of angels are a favorite topic of post-canonical and especially of Apocalyptic literature. In the book of Enoch, cherubim, seraphim, and even the wheels of Ezekiel's vision, become distinct classes of angels; and Rafael (*see* Tobit xii. 5), Phanuel, Uriel, etc., are added to the names of individual archangels. Specially celebrated is the interpretation which this book gives of Genesis vi. 2, where the sons of God are understood as angels. This interpretation seems to have influenced Jude, verse 6 (*see* 2 Peter ii. 4), was current in the early church as well as in Judaism, and (though the narrative so understood is quite unique in the circle of Biblical ideas) is defended on philological grounds by the best recent scholars, the occurrence being viewed as history or as myth, according as the interpreter is theosophically or critically inclined. Of other passages in later Jewish literature it may suffice to refer to the full account of the creation of angels of various functions, presiding over various powers of Nature, in "The Book of Jubilees" (*see* Roensch, "Das Buch der Jubiläen," p. 259).

The angelology of the New Testament attaches closely to the notions already developed. The ministry of angels is, as in the Old Testament, specially connected with the work of salvation (Hebrews i. 14), and with the person of Christ (John i. 51), to whom after the temptation (and at Gethsemane?) angels minister, and who can at will command their aid (Matthew xxvi. 53). As in the later Old Testament books, revelations by angels are given in vision or dream, but even waking eyes see the angel or angels who minister at the resurrection. So an angel delivers Peter (Acts xii.), etc. As in the Old Testament, the figure of angels is human, their raiment white, and their aspect luminous. A multitude of angels appear singing praises at the nativity (Luke ii. 13), and in general they sympathize with the repentance of sinners and the progress of the divine kingdom (Luke xv. 10; 1 Peter i. 12). Gabriel reappears in Luke i. The belief in special guardian angels of individuals appears as current (Acts xii. 15), but the words of Jesus (Matthew xviii. 10) hardly go farther than the statements of the Psalms. The angelic hosts of the prophetic eschatology are naturally transferred to the second coming (Parusia) of our Lord. The saints after the resurrection are like the angels (Matthew xxii. 30; Luke xx. 36). In the Apocalypse angels play a great part. Notable features, in addition to the seven highest angels (viii. 2), are the angels of the seven churches (who, however, are by many taken as human figures, church officers), and the association of special angels with cosmical forces, e. g., angels of fire and water (xvi. 5, xiv. 18). The same idea appears even more sharply expressed in the writings of Paul, if, as Ritschl has rendered plausible, the elements (elemental powers) of the world (Colossians ii.; Galatians iv. 3) are the angels, and specially the angels of the law. This view is connected with the characteristic position of Paul and the Epistle to the Hebrews, that the inferiority of the old covenant is stamped by the fact that the law was given and enforced by angels (Galatians iii., iv.; Hebrews ii.; *see* Acts vii. 53), an idea partly based on Exodus xxiii. 20, *sq.*, and partly on a transference to Sinai of the usual poetico-prophetic imagery of a theophany — a transference suggested by

Psalm lxviii. 17, Deuteronomy xxxiii. 2, and actually carried out in the LXX. translation of the latter text, and in the current Jewish theology of the period. Angel-worship is condemned in Colossians ii. (probably with reference to Essene doctrine); *see* Revelation xix. 10. In Hebrews ii., and 1 Corinthians vi. 3, Christians are superior to angels.

Theological reflection on the doctrine of angels already begins among the Alexandrian Jews; and Philo, who calls them "a chorus of unembodied souls" occupying the air, places them in close parallelism to his speculations on the divine *ideas* or *powers*. From this association the transition is easy to Gnostic speculations, where the ranks of angels appear as produced by successive emanation, and thus serve to fill up the interval which Gnosticism puts between God and the world.

In this connection we find also a doctrine of creation by angels (Basilides), and dualistic views of good and evil angels. Against these heresies the early Church emphasizes the creation of angels and the fall of the evil angels, but Origen tells us that up to his time the ecclesiastical doctrine did not define "quando isti creati sint vel quales aut quomodo sint." On these topics, however, many subtile questions arose, e. g., whether angels have bodies of an ethereal kind, whether they were created before the world or along with the light, etc. Gradually angel-worship sprung up, and in spite of the opposition of the best Fathers (Theodoret, Augustine, etc.) became firmly established, and is still acknowledged in the Roman Catechism. An elaborate theory of the angelic hierarchy, based on Neoplatonic doctrines, is laid down in the work of Pseudo-Dionysius, "De Hierarchia Celesti" (fifth century), and exercised much influence on mediæval theology, which accepted the work as a genuine product of the apostolic age. The schoolmen treat of angels under the doctrine of creation, dividing rational creatures into angels, who are pure spirits, and men ("Sent.," lib. ii., dist. i., *sqq.*); and the nature and powers of angels form the most notorious problems of the misdirected subtilty of the schools (*see*, e. g., Duns on the "Second Book of Sentences"). Protestant theologians have always felt less interest in the subject, and generally reduce the doctrine of angels to a mere appendix to the doctrine of creation or of God's works. Recent writers often go much farther. Thus, Schleiermacher sums up the whole doctrine of angels by saying that the possible existence of angels should not influence conduct, and that revelations of their being are no more to be looked for. A reaction, partly rooted on the later philosophy of Schelling, has led several German theologians (Hofmann, etc.) to lay more weight on the doctrine.

The Biblical doctrine of angels must be studied with the aid of the best books on Biblical theology (Schulz, Oehler, Ewald, Weiss, etc.), and of the commentaries on special passages. The book of Enoch is accessible in Dellmann's translation, and other Jewish notions may be found in Eisenmenger. The literature of the subject, theological and theosophic, is immense.—("Encyclopædia Britannica," new edition.)

THE PRACTICAL SIDE OF COÖPERATIVE HOUSEKEEPING.

By ROSWELL FISHER.

FOR some years past the growing expense and troubles of ordinary housekeeping have driven thoughtful people to consider whether the great principles of association and coöperation are not as applicable to domestic as to commercial undertakings.

To-day the existence of several more or less successful attempts to carry the idea into practice shows that the subject has outgrown its purely speculative phase, and is therefore entitled to be considered one of the practical problems of the age.

Notwithstanding, however, that there is a great and fast-growing interest taken in the subject, more especially by harassed and weary housekeepers, there is still no little misconception abroad as to the character and scope of coöperative housekeeping, not only on the part of the public, but even on the part of some of those who have practically tried to solve the problem.

The misconceptions most prevalent with the public seem to have arisen partly through the fault of those who have advocated the scheme as primarily a social or even socialist reform or

revolution, which has been quite sufficient to excite the prejudices and antagonism of numbers; and partly from the natural instinct on the part of those to whom the idea is newly presented to judge the new scheme by past experiences of no inviting kind acquired in ordinary boarding-houses, hotels, or barracks. On the other hand, those who have made unsuccessful or partially successful experiments have altogether overlooked, or insufficiently apprehended at least, some of those conditions which I hope in the present essay to show are absolutely essential to the successful working of the system. My object is to present the inception and gradual growth of the scheme, merely as the application of well-known economical principles to domestic living, from which indeed, as from the introduction of steam, certain social advantages may or may not incidentally arise, but which are not necessary to its success.

In pursuit of this purpose it is my intention to try and bring out those features and conditions which I believe to be absolutely essential to the successful working of the scheme in its various stages, rather than to draw a fancy sketch of the ideal Coöperative Mansion, or to describe one or more of the actual experiments which are now being made in and about London.

The first idea which seems to spring up in the minds of those who desire domestic economy and efficiency—two phases of the same thing—is how clumsy, how troublesome, how extravagant are private kitchens and cooks with their paraphernalia. Could not we with a well-arranged kitchen cook for several ordinary families with a great economy in plant, fuel, wages, and perhaps marketing; or, to put the question conversely, is it not clear that if several families club together to engage a common cook, kitchen, and appurtenances, their table expenses could be very materially reduced? It requires no argument to answer such questions in the affirmative, and, unless I am misinformed, several attempts have been made to act on this conclusion, with almost, if not altogether, complete failure. Nor could we reasonably expect a more successful result. If several families, either in one large or several ordinary houses, undertake a joint kitchen, they must not only adopt a common scale of table expenses, but must possess common tastes; otherwise their meals must be cooked and served on different scales, at different times, to the great detriment of economy. Differences of means and tastes, however, would be trifles in comparison with the difficulties of managing such a joint establishment. Should all the lady heads jointly undertake the management, or should they take it in turn, or should the whole conduct be relegated to one? It needs no argument to show that, except in the rarest cases, any one of these three methods, or of any other demanding the services in management of the various heads of the families, would prove fatal, from the differences of capacity, of tastes, and of temper, which would be possessed by the individual heads. We are therefore driven to the conclusion that the undertaking of a joint kitchen establishment by a few families, though economical in principal, would almost inevitably fail in practice. To return to the principle, however, it is clear that if ten associated families could theoretically be served with their food more economically than ten individual families, then, on ordinary wholesale principles, one hundred families could be served more cheaply than ten, and so on, up to that point at which the most expensive employés and articles of plant would need to be doubled. Then we may safely assert that largeness of scale is almost essential for economy, and is absolutely essential for harmony and practical efficiency. For largeness of scale not only guarantees the possibility of meeting various means and tastes, but, what is of even greater importance, it postulates professional, that is, paid management, which at once disposes of the difficulty of joint management by the lady heads with their different qualities and capacities.

Such a scale, however, as would afford the desired variety in the fare, and would economically support trained professional management, would demand for economy and efficiency that it should be carried on under conditions especially adapted to its largeness, and therefore a suitable kitchen and appurtenances would be required. We have thus aimed at the establishment of an associated kitchen, which, dispensing with private cooks and their appurtenances, may be said to mark the first stage of associated housekeeping. That such a kitchen could furnish a wide area of ordinary houses with well-cooked and hot meals, no one who has any experience of foreign *traiteurs* or of the college kitchens of Oxford and Cambridge will deny.

There are doubtless great numbers who would willingly go so far in associated housekeeping, but whose interests or prejudices would prevent them going farther. In the interests, however, of those who would wish to apply the same principles to house service, it would require little

skill to attach to the associated kitchen a staff of general house-servants, by whose organized services a greater efficiency and subdivision of labor, with their ensuing economy, might be obtained. The abolition of the private house service, as well as the private kitchen, marks the second stage of associated housekeeping.

At this point the question naturally presents itself, "Are our present dwellings so situated and arranged as to permit their tenants to get the greatest benefit from such an associated kitchen and chamber service?" Not only are they very far from being so, but it is notorious that they are so ill adapted from want of variety in their size and plan, together with their relatively enormous rents, to the growing wants and changing demands of modern life in large towns, that buildings in flats, or apartments differing in the number and arrangement of their rooms, such as have long been universal abroad, are becoming more common and more and more in demand, at all events in London. Such buildings, if constructed with a due regard to variety of room arrangement, to economy in stairs and corridors, and to height, offer, quite apart from the common kitchen and service, great advantages both in convenience and economy.

Great height being one of the elements, lifts become an essential feature; and it then becomes an object so to lay out the building that, with a due regard to safety and efficiency, the greatest possible number of apartments shall be served by the fewest possible stairs and lifts with their attendant expenses. One stair and lift, which may be necessary for twenty apartments, may, with a slight increase of size, be equal to the requirements of one hundred apartments. But the very modifications of plan which would be necessary to afford the greatest efficiency and economy in the arrangement of the rooms, in the stairs, the lifts, the porters, engineers, etc., would also be those under which the coöperative kitchen and general staff of house and chamber servants would work to the greatest advantage. Therefore, if to the mansion, so built as to secure the greatest economy and comfort in its individual apartments or dwellings, the associated kitchen and staff be added, we find ourselves brought to the associated mansion—not, indeed, fully developed, but sufficiently complete for practical working. No sooner, however, is the idea of such an associated mansion grasped, than we jump to the conclusion that in the interests of economy a coffee-room or general dining-room would be, if not an essential, at least a desirable feature of such an establishment; for it is obvious that the one, two, or five hundred meals cooked in the common kitchen could be much more cheaply served in one or two large rooms than in as many rooms as there were meals. This introduction of the coffee-room at once affords us a fresh argument in favor of the assertion that largeness of scale is the first *essential* of the scheme. For if the number of meals to be served is small, economy practically demands that they shall be served as *tables d'hôte*. This I believe to be undesirable—first, because it argues a common scale of living and common hours for eating; secondly, because, though dining at a *table d'hôte* while on a tour is often amusing, it becomes as a daily system tiresome, and a possible fruitful source of unpleasantness between the people who sit next each other day after day. The great American hotels have long given up the *table d'hôte* for what we may call the restaurant system of separate tables.

If my argument so far is sound, it may be stated as an axiom that the associated mansion, like the kitchen, must be *at least* on a scale large enough to support professional management, and from that point, within certain very wide limits, we may say the larger the scale the greater the economy and efficiency.[1] Many may here object that, after all, the proposed mansion is only a modified grand hotel. Very true, but the modifications are most important, as a slight reference to the principles on which ordinary hotels and boarding-houses are conducted will show. In ordinary hotels and boarding-houses the object is to make the greatest possible profit. This profit is made both in the board and lodging, but it is generally well understood that the greater proportion is made in the board; therefore it is an object to accommodate the greatest possible number of boarders, which in turn raises the price of private sitting and reception rooms. The result of this is that where economy is an object, the luxury of private reception-rooms is foregone, and domestic privacy is almost destroyed. At the same time it is well to bear in mind that no more exclusive privacy can be enjoyed than in a great hotel, more especially perhaps in one of the colossal American caravansaries, always supposing that money is no object. In the associated man-

[1] Subject to being built with due regard to the essential conditions of size, and of the dwellings being so grouped as to afford the greatest privacy compatible with the efficient and economical working and administration of the whole, the coöperative mansion may take any form or shape which the ingenuity of architects may be able to devise.

sion, on the other hand, the object is to retain and even increase the opportunities for domestic privacy, while gaining the economic advantages of association. For this purpose it is essential that the rooms or dwellings should be taken quite independently of board. To bring this and the other distinguishing features of the proposed associated coöperative mansion into the strongest light, I shall try and give a short sketch of a family taking up its residence in such a mansion. On finding a suite of rooms answering their requirements in size and number, they ask the terms, and are told that the rent, taxes, and service of the suite, cost so much per annum. Thus in paying this one item the head of the family disposes at once of the rent of his dwelling, his share of the rent of the windows, stairs, and common portion of the dwelling-parts of the house, his rates, water, gas, and perhaps general heating, his own house service, and his share of the common service, such as porters, lift-attendants, and so on. For board they are referred to the restaurant department. On consulting the tariff they find that they can either order each meal as in a club, or they can be boarded at so much per head per day, the price varying according to the number and class of meals which they take. In the latter case they would be able at a glance to calculate accurately their yearly average table-expenses, which would be a great advantage to numbers of people. They would further find that if there was a coffee-room the tariff would be rather lower there than if their meals were served in their private apartments.[1] Here at once all the trouble of engaging cooks and buying food and utensils is disposed of. It is evident that if the family, on taking up their abode in such a mansion, preferred to pay the slight increase demanded for dining in their own rooms, and never entered the coffee-room, they could live for years without knowing even by sight, much less by social intercourse, any of the other members of the mansion. This at once disposes of the common misconception that almost forced social intercourse would be an essential feature of the associated mansion. It is also clear that such a system of living would at once free wives and mothers from the drudgery of housekeeping which at present weighs so heavily on their energies. If, in addition to the economic advantages which would be presented by such a mansion, the opportunity for social intercourse was desired by the members, the addition of a general *salon* or drawing-room, and as many more common advantages as the different constituencies might desire and for which they might be willing to pay, would present no difficulties, and though, I believe, a desirable incident of the scheme, is by no means essential to its success. In reference to the social possibilities of the associated mansion I may merely remark that the common assumption that in the introduction of a *salon* there would or might be a great increase to scandal and quarrels is, I believe, totally opposed to the experience of large clubs and hotels. It is perfectly true that in a small coffee or drawing room, as in a small town or village, people are both likely all to know each other and to make their neighbors the subject of remarks of very often not the most friendly kind; whereas in a large coffee or drawing room, no less than in a large town, people need not know each other, much less concern themselves about the doings and sayings of people to whom they are indifferent. From this it is clear that, no less on the social than on the economic side of the question, largeness of scale is essential to success.

So far I have confined my argument to the endeavor to show clearly the advantages and the essential conditions of associated housekeeping. It is, however, no less important to show that, in order to gain the full advantages of economy, the system must be worked on more or less coöperative and not on commercial principles. Associated housekeeping on commercial principles, carried out more or less in the manner I have described in the great American and Continental and in some English hotels and mansions, is a common and very successful fact, but hitherto has not succeeded in being at once economical and efficient. Nor is this surprising when we consider that the interests of the proprietors and of the tenants—that is, of the sellers and buyers—have been and are, as in all trades, antagonistic; therefore efficiency means dearness, cheapness means inefficiency. To illustrate this in reference to my argument, let us take first the case of the associated kitchen. If this is undertaken purely as a commercial enterprise, the chances are overwhelmingly great that when once the customers had put down their private kitchen department, and had thus deeply committed themselves to the new system, the *entrepreneur* would either gradually fall off in the quality, or would raise the price of his supplies. For reasons which I believe are clear, but rather long to introduce here, the ordinary principles of competition would fail to rectify this danger even in the associated

[1] Of course, on account of the extra cost of so serving the meal.

kitchen alone, and still more so in the associated mansion. There it is of great importance that the kitchen should be owned or rented and more or less managed by those who are to benefit by its establishment. I say *more* or *less* managed, because it is doubtful whether the experience of many clubs does not show that the purely cooperative management of a kitchen by the club committee is not, from waste, carelessness, extravagance, and pilfering, more costly than the profits which would be exacted by the caterer. I venture after much inquiry, discussion, and consideration, to offer two plans of management for the restaurant department, neither of which would greatly strain the energies or intelligence of the committee. In using the terms club and members in this connection, they must be understood to refer exclusively to the customers of the kitchen and tenants of the mansion, who, whether they are or are not proprietors, must be themselves, as in the case of the coöperative stores, both buyers and sellers. In all cases the committee should fix the rent of the kitchen with its appurtenances, and the coffee-room, if there was one; then in the first place they would farm the restaurant to the most satisfactory bidder, stating in their call for tenders the rent, the average daily attendance and requirements, and the probable extraordinary demands, and finally stating that the tenure of the office should be absolutely conditional on the successful tenderer satisfactorily fulfilling his contract. In this case, as the contractor would have a far more certain demand than the ordinary hotel or restaurant keeper, or even club cook, he should be able to tender on very low terms; and as the tenure of a position offering certain profits would be conditional on the satisfactory fulfillment of his contract, he would have the strongest inducements to maintain the standard of his tender.

On the alternative plan the club committee should themselves contract with wholesale producers and purveyors for the supply of the kitchen; they should engage a *chef* and inferior employés at usual salaries, and should then fix the tariff at such a rate as should afford a fair margin of profit, of which profit the *chef*, and as many of the inferior employés as it might be deemed advisable to bind to the interest of the club, should get a certain percentage, and the balance should be distributed among the members on the usual coöperative principles—that is, in proportion to their purchases. Of these two plans the former is the simplest, the latter the more truly coöperative. The restaurant department being disposed of either as above suggested, or in some equally satisfactory way, the engaging of the housekeeping staff and of a managing secretary should present no great difficulties, and needs no discussion.

Before leaving the question of administration, it may be remarked that, in the case of the cooperative kitchen alone, or in that of a mansion which offered no opportunities for social intercourse, the financial position of the members would, as in any ordinary company, be the only necessary or desirable test for membership, and their directors or committee should be elected as in any other commercial or coöperative undertaking. If, however, the *salon* is a feature of the mansion, the social position of the members becomes a question of importance, and admittance should be obtained by ballot or approval of the committee as in ordinary clubs.

I have now endeavored to describe as shortly and clearly as possible the natural rise and growth of the idea of coöperative housekeeping, showing that it is no socialist Utopia, but merely the application of modern economical principles and mechanical appliances in a somewhat new direction. I have sought to demonstrate that the conditions absolutely essential to success are —1. Largeness of scale; 2. The retention of domestic privacy by separation of the board and dwelling departments; and, 3. Its administration on at least modified coöperative and not on purely commercial principles. These conditions are, I believe, equally demanded by, and equally applicable to, all stages of the system, from the establishment of coöperative kitchens up to the creation and administration of that ideal coöperative mansion of the, I trust, not very distant future, which, presenting to the world an imposing and even splendid exterior, shall offer to its one or two thousand members the individual enjoyment of a great variety of dwellings, differing in the number, size, and position of their rooms according to the wants, taste, and means of their tenants, together with the common enjoyment of spacious, well-warmed, well-ventilated halls, corridors, and staircases; of lifts, of the services of porters, commissionnaires, and call-boys, of firemen and watchmen; which shall offer the opportunity of using a steam-laundry, a special post and telegraph office, of Turkish and other baths and lavatories, of a Kinder-Garten and of a hospital suite; which shall offer the opportunity of enjoying large and small drawing and dining rooms, of music, dancing, and card rooms, of libraries and reading-rooms,

of smoking and of billiard rooms, in which the individual members and families may either enjoy more completely than is now possible that amiable social isolation and exclusiveness which we are told is so dear to the true Briton, or, on the other hand, may, without extra trouble or expense, enjoy as much as they wish of the society of their fellow-members—the whole, if conducted on true coöperative principles, to be obtained at a smaller cost than we now pay for our unsatisfactory dwellings and servants, and with the further gain of an almost complete freedom from household cares.

It is asserted that English people are too conservative to adopt so fundamental a revolution in their ideas of dwellings and housekeeping. I answer, the facts show the contrary. Not only are great numbers of people, some from necessity, others from choice, more and more living in boarding-houses, hotels, and flats, but the continued success of the well-known mansions in Grosvenor Gardens for the past ten years, of the kindred erections in Victoria Street and elsewhere, which are being repeated with modern improvements on a considerable scale, as well as the great success of the vast pile at Queen Anne's Gate, is sufficient proof that the British public is ready largely to avail itself of such dwellings and style of living as more or less closely approach the idea of coöperative housekeeping, which it has been my object rather to put on a practical basis than to argue its advantages at length. Though I have discussed the question in this essay as if it were one purely affecting the upper-middle and upper classes, with whom it must probably begin, yet the system is even more desirable for the lower-middle and lower classes, who are, I believe, relatively more wastefully lodged and fed than their richer neighbors. It is true that the less educated are more prejudiced and less capable of clubbing together than the better educated classes; but, judging from the success which has attended the efforts to get the artisans to give up their little homes or hovels for homes in blocks, it will not, I venture to say, be very long before they will see the economic advantages of a common kitchen and the social advantages of a club-room, which would probably prove a successful and healthy rival to the public-house.

In the present essay I have confined myself to laying down the principles which I believe are essential to the successful working of wholesale housekeeping. To fully develop the economic and social possibilities of the system, and to answer fairly and completely all the objections which timid and conservative people urge against it, would take me far beyond the limits of a magazine article. In conclusion, I venture to say that I have the strongest reasons for believing that, if the public can only once fairly grasp the idea that coöperative housekeeping is no social chimera, but is merely a recombination of the soundest and most successful facts, it will not be long before coöperative mansions are not only very common, but will be regarded as among the very best investments in real property.

—*Nineteenth Century.*

THE COLORS OF ANIMALS AND PLANTS.

By ALFRED RUSSEL WALLACE.

I.—THE COLORS OF ANIMALS.

THERE is probably no one quality of natural objects from which we derive so much pure and intellectual enjoyment as from their colors. The "heavenly" blue of the firmament, the glowing tints of sunset, the exquisite purity of the snowy mountains, and the endless shades of green presented by the verdure-clad surface of the earth, are a never-failing source of pleasure to all who enjoy the inestimable gift of sight. Yet these constitute, as it were, but the frame and background of a marvelous and ever-changing picture. In contrast with these broad and soothing tints, we have presented to us, in the vegetable and animal worlds, an infinite variety of objects adorned with the most beautiful and most varied hues. Flowers, insects, and birds, are the organisms most generally ornamented in this way; and their symmetry of form, their variety of structure, and the lavish abundance with which they clothe and enliven the earth, cause them to be objects of

universal admiration. The relation of this wealth of color to our mental and moral nature is indisputable. The child and the savage alike admire the gay tints of flower, bird, and insect; while to many of us their contemplation brings a solace and enjoyment which is both intellectually and morally beneficial. It can then hardly excite surprise that this relation was long thought to afford a sufficient explanation of the phenomena of color in Nature; and although the fact that—

> "Full many a flower is born to blush unseen,
> And waste its sweetness on the desert air"—

might seem to throw some doubt on the sufficiency of the explanation, the answer was easy—that, in the progress of discovery, man would, sooner or later, find out and enjoy every beauty that the hidden recesses of the earth have in store for him. This theory received great support from the difficulty of conceiving any other use or meaning in the colors with which so many natural objects are adorned. Why should the homely gorse be clothed in golden raiment, and the prickly cactus be adorned with crimson bells? Why should our fields be gay with buttercups, and the heather-clad mountains be clad in purple robes? Why should every land produce its own peculiar floral gems, and the Alpine rocks glow with beauty, if not for the contemplation and enjoyment of man? What could be the use to the butterfly of its gayly-painted wings, or to the humming-bird of its jeweled breast, except to add the final touches to a world-picture, calculated at once to please and to refine mankind? And even now, with all our recently-acquired knowledge of this subject, who shall say that these old-world views were not intrinsically and fundamentally sound; and that, although we now know that color has "uses" in Nature that we little dreamed of, yet the relation of those colors to our senses and emotions may be another and perhaps more important use which they subserve in the great system of the universe?

We now propose to lay before our readers a general account of the more recent discoveries on this interesting subject; and, in doing so, it will be necessary first to give an outline of the more important facts as to the colors of organized beings; then to point out the cases in which it has been shown that color is of use; and, lastly, to endeavor to throw some light on its nature, and the general laws of its development.

Among naturalists, color was long thought to be of little import, and to be quite untrustworthy as a specific character. The numerous cases of variability of color led to this view. The occurrence of white blackbirds, white peacocks, and black leopards; of white bluebells, and of white, blue, or pink milkworts, led to the belief that color was essentially unstable, that it could therefore be of little or no importance, and belonged to quite a different class of characters from form or structure. But it now begins to be perceived that these cases, though tolerably numerous, are, after all, exceptional; and that color, as a rule, is a constant character. The great majority of species, both of animals and plants, are each distinguished by peculiar tints which vary very little, while the minutest markings are often constant in thousands or millions of individuals. All our field buttercups are invariably yellow, and our poppies red, while many of our butterflies and birds resemble each other in every spot and streak of color through thousands of individuals. We also find that color is constant in whole genera and other groups of species. The Genistas are all yellow, the Erythrinas all red, many genera of Carabidæ are entirely black, whole families of birds—as the Dendrocolaptidæ—are brown, while among butterflies the numerous species of Lycæna are all more or less blue, those of Pontia white, and those of Callidryas yellow. An extensive survey of the organic world thus leads us to the conclusion that color is by no means so unimportant or inconstant a character as at first sight it appears to be; and the more we examine it the more convinced we shall become that it must serve some purpose in Nature, and that besides charming us by its diversity and beauty it must be well worthy of our attentive study, and have many secrets to unfold to us.

In order to group the great variety of facts relating to the colors of the organic world in some intelligible way, it will be best to consider how far the chief theories already proposed will account for them. One of the most obvious and most popular of these theories, and one which is still held, in part at least, by many eminent naturalists, is, that color is due to some direct action of the heat and light of the sun, thus at once accounting for the great number of brilliant birds, insects, and flowers, which are found between the tropics. But here we must ask whether it is really the fact that color is more developed in tropical than in temperate climates, in proportion to the whole number of species; and, even if we find this to be so, we have to inquire whether there are not so many and such striking exceptions to the rule as to indicate some other causes at work than the direct influence of solar light and heat. As this is a most important question, we must go into it somewhat fully.

It is undoubtedly the case that there are an immensely greater number of richly-colored birds and insects in tropical than in temperate and cold countries; but it is by no means so certain that the *proportion* of colored to obscure species is much or any greater. Naturalists and collectors well know that the majority of tropical birds are dull-colored; and there are whole families, comprising hundreds of species, not one of which exhibits a particle of bright color. Such are the Timaliidæ of the Eastern and the Dendrocolaptidæ of the Western Hemispheres. Again, many groups of birds, which are universally distributed, are no more adorned with color in the tropical than in the temperate zone; such are thrushes, wrens, goat-suckers, hawks, grouse, plovers, and snipe; and if tropical light and heat have any direct coloring effect, it is certainly most extraordinary that in groups so varied in form, structure, and habits, as those just mentioned, the tropical should be in no wise distinguished in this respect from the temperate species. The brilliant tropical birds mostly belong to groups which are wholly or almost wholly tropical—as the chatterers, toucans, trogons, and pittas; but as there are, perhaps, an equal number of groups which are wholly dull-colored, while others contain dull and bright colored species in nearly equal proportions, the evidence is by no means strong that tropical light or heat has anything to do with the matter. But there are also groups in which the cold and temperate zones produce finer-colored species than the tropics. Thus the arctic ducks and divers are handsomer than those of the tropical zone, while the king-duck of temperate America and the mandarin-duck of Northern China are the most beautifully colored of the whole family. In the pheasant family we have the gorgeous gold and silver pheasants in Northern China and Mongolia; and the superb impeyan pheasant in the temperate Northwest Himalayas, as against the peacocks and fire-backed pheasants of tropical Asia. Then we have the curious fact that most of the bright-colored birds of the tropics are denizens of the forests, where they are shaded from the direct light of the sun, and that they abound near the equator, where cloudy skies are very prevalent; while, on the other hand, places where light and heat are at a maximum have often dull-colored birds. Such are the Sahara and other deserts, where almost all the living things are sand-colored; but the most curious case is that of the Galapagos Islands, situated under the equator, and not far from South America, where the most gorgeous colors abound, but which are yet characterized by prevailing dull and sombre tints in birds, insects, and flowers, so that they reminded Mr. Darwin of the cold and barren plains of Patagonia. Insects are wonderfully brilliant in tropical countries generally, and any one looking over a collection of South American or Malayan butterflies would scout the idea of their being no more gayly colored than the average of European species, and in this they would be undoubtedly right. But on examination we should find that all the more brilliantly colored groups were exclusively tropical, and that, where a genus has a wide range, there is little difference in coloration between the species of cold and warm countries. Thus the European Vanessides, including the beautiful "peacock," "Camberwell beauty," and "red admiral" butterflies, are quite up to the average of tropical beauty in the same group, and the remark will equally apply to the little "blues" and "coppers;" while the Alpine "apollo" butterflies have a delicate beauty that can hardly be surpassed. In other insects, which are less directly dependent on climate and vegetation, we find even greater anomalies. In the immense family of the Carabidæ or predaceous ground-beetles, the northern forms fully equal, if they do not surpass, all that the tropics can produce. Everywhere, too, in hot countries, there are thousands of obscure species of insects which, if they were all collected, would not improbably bring down the average of color to much about the same level as that of temperate zones.

But it is when we come to the vegetable world that the greatest misconception on this subject prevails. In abundance and variety of floral color the tropics are almost universally believed to be preëminent, not only absolutely, but relatively to the whole mass of vegetation and the total number of species. Twelve years of observation among the vegetation of the Eastern and Western tropics has, however, convinced me that this notion is entirely erroneous, and that, in proportion to the whole number of species of plants, those having gayly-colored flowers are actually more abundant in the temperate zones than between the tropics. This will be found to be not so extravagant an assertion as it may at first appear, if we consider how many of the choicest adornments of our greenhouses and flower-shows are really temperate as opposed to tropical plants. The masses of color produced by our rhododendrons, azaleas, and camellias, our pelargoniums, calceolarias, and cinerarias—all strictly temperate plants—can certainly not be surpassed, if they

can be equaled, by any productions of the tropics.[1] But we may go further, and say that the hardy plants of our cold temperate zone equal, if they do not surpass, the productions of the tropics. Let us only remember such gorgeous tribes of flowers as the roses, peonies, hollyhocks, and antirrhinums; the laburnum, Wistaria, and lilac; the lilies, irises, and tulips; the hyacinths, anemones, gentians, and poppies, and even our humble gorse, broom, and heather; and we may defy any tropical country to produce masses of floral color in greater abundance and variety. It may be true that individual tropical shrubs and flowers do surpass everything in the rest of the world, but that is to be expected, because the tropical zone comprises a much greater land-area than the two temperate zones, while, owing to its more favorable climate, it produces a still larger proportion of species of plants, and a great number of peculiar natural orders.

Direct observation in tropical forests, plains, and mountains, fully supports this view. Occasionally we are startled by some gorgeous mass of color, but as a rule we gaze upon an endless expanse of green foliage, only here and there enlivened by not very conspicuous flowers. Even the orchids, whose gorgeous blossoms adorn our stoves, form no exception to this rule. It is only in favored spots that we find them in abundance; the species with small and inconspicuous flowers greatly preponderate; and the flowering season of each kind being of short duration, they rarely produce any marked effect of color amid the vast masses of foliage which surround them. An experienced collector in the Eastern tropics once told me that, although a single mountain in Java had produced three hundred species of Orchideæ, only about two per cent. of the whole were sufficiently ornamental or showy to be worth sending home as a commercial speculation. The Alpine meadows and rock-slopes, the open plains of the Cape of Good Hope or of Australia, and the flower-prairies of North America, offer an amount and variety of floral color which can certainly not be surpassed, even if it can be equaled, between the tropics.

It appears, therefore, that we may dismiss the theory that the development of color in Nature is directly dependent on, and in any way proportioned to, the amount of solar heat and light, as entirely unsupported by facts. Strange to say, however, there are some rare and little-known phenomena which prove that, in exceptional cases, light does directly affect the colors of natural objects, and it will be as well to consider these before passing on to other matters.

A few years ago Mr. T. W. Wood called attention to the curious changes in the color of the chrysalis of the small cabbage-butterfly (*Pontia rapæ*) when the caterpillars were confined in boxes lined with different tints. Thus in black boxes they were very dark, in white boxes nearly white; and he further showed that similar changes occurred in a state of nature, chrysalises fixed against a whitewashed wall being nearly white, against a red-brick wall reddish, against a pitched paling nearly black. It has also been observed that the cocoon of the emperor-moth is either white or brown, according to the surrounding colors. But the most extraordinary example of this kind of change is that furnished by the chrysalis of an African butterfly (*Papilio Nireus*), observed at the Cape by Mrs. Barber, and described (with a colored plate) in the "Transactions of the Entomological Society," 1874, page 519. The caterpillar feeds on the orange-tree, and also on a forest-tree (*Vepris lanceolata*) which has a lighter green leaf, and its color corresponds with that of the leaves it feeds upon, being of a darker green when it feeds on the orange. The chrysalis is usually found suspended among the leafy twigs of its food-plant, or of some neighboring tree; but it is probably often attached to larger branches, and Mrs. Barber has discovered that it has the property of acquiring the color, more or less accurately, of any natural object it may be in contact with. A number of the caterpillars were placed in a case with a glass cover, one side of

[1] It may be objected that most of the plants named are choice cultivated *varieties*, far surpassing in color the original stock, while the tropical plants are mostly unvaried wild *species*. But this does not really much affect the question at issue. For our florists' gorgeous varieties have all been produced under the influence of our cloudy skies, and with even a still further deficiency of light, owing to the necessity of protecting them under glass from our sudden changes of temperature; so that they are themselves an additional proof that tropical light and heat are not needed for the production of intense and varied color. Another important consideration is, that these cultivated *varieties* in many cases displace a number of wild *species* which are hardly, if at all, cultivated. Thus there are scores of *species* of wild hollyhocks varying in color almost as much as the cultivated varieties, and the same may be said of the pentstemons, rhododendrons, and many other flowers; and if these were all brought together in well-grown specimens, they would produce a grand effect. But it is far easier, and more profitable, for our nurserymen to grow *varieties* of one or two species, which all require a very similar culture, rather than fifty distinct *species*, most of which would require special treatment; the result being that the varied beauty of the temperate flora is even now hardly known, except to botanists and to a few amateurs.

the case being formed by a red-brick wall, the other sides being of yellowish wood. They were fed on orange-leaves, and a branch of the bottle-brush-tree (*Banksia, sp.*) was also placed in the case. When fully fed, some attached themselves to the orange-twigs, others to the bottle-brush-branch; and these all changed to green pupæ; but each corresponded exactly in tint to the leaves around it, the one being dark, the other a pale, faded green. Another attached itself to the wood, and the pupa became of the same yellowish color; while one fixed itself just where the wood and brick joined, and became one side red, the other side yellow! These remarkable changes would perhaps not have been credited, had it not been for the previous observations of Mr. Wood; but the two support each other, and oblige us to accept them as actual phenomena. It is a kind of natural photography, the particular colored rays to which the fresh pupa is exposed, in its soft, semi-transparent condition, effecting such a chemical change in the organic juices as to produce the same tint in the hardened skin. It is interesting, however, to note that the range of color that can be acquired seems to be limited to those of natural objects to which the pupa is likely to be attached; for when Mrs. Barber surrounded one of the caterpillars with a piece of scarlet cloth no change of color at all was produced, the pupa being of the usual green tint, but the small red spots with which it is marked were brighter than usual.

In these caterpillars and pupæ, as well as in the great majority of cases in which a change of color occurs in animals, the action is quite involuntary; but among some of the higher animals the color of the integument can be modified at the will of the animal, or, at all events, by a reflex action dependent on sensation. The most remarkable case of this kind occurs with the chameleon, which has the power of changing its color from dull white to a variety of tints. This singular power has been traced to two layers of pigment deeply seated in the skin, from which minute tubes, or capillary vessels, rise to the surface. The pigment-layers are bluish and yellowish, and by the pressure of suitable muscles these can be forced upward either together or separately. When no pressure is exerted the color is dirty white, which changes to various tints of bluish, green, yellow, or brown, as more or less of either pigment is forced up and rendered visible. The animal is excessively sluggish and defenseless, and its power of changing its color to harmonize with surrounding objects is essential to its existence. Here, too, as with the pupa of *Papilio Nireus*, colors such as scarlet or blue, which do not occur in the immediate environment of the animal, cannot be produced. Somewhat similar changes of color occur in some prawns and flat-fish, according to the color of the bottom on which they rest. This is very striking in the chameleon-shrimp (*Mysis Chamæleon*), which is gray when on sand, but brown or green when among seaweed of these two colors. Experiment shows, however, that when blinded the change does not occur, so that here too we probably have a voluntary or reflex sense-action. Many cases are known among insects in which the same species has a different tint according to its surroundings, this being particularly marked in some South African locusts which correspond with the color of the soil wherever they are found; while several caterpillars which feed on two or more plants vary in color accordingly. Several such changes are quoted by Mr. R. Meldola, in a paper on "Variable Protective Coloring in Insects" ("Proceedings of the Zoölogical Society of London," 1873, page 153), and some of them may perhaps be due to a photographic action of the reflected light. In other cases, however, it has been shown that green chlorophyll remains unchanged in the tissues of leaf-eating insects, and being discernible through the transparent integument produces the same color as that of the food-plant.

These peculiar powers of change of color and adaptation are, however, rare and quite exceptional. As a rule there is no direct connection between the colors of organisms and the kind of light to which they are usually exposed. This is well seen in most fishes, and in such marine animals as porpoises, whose backs are always dark, although this part is exposed to the blue and white light of the sky and clouds, while their bellies are very generally white, although these are constantly subjected to the deep-blue or dusky-green light from the bottom. It is evident, however, that these two tints have been acquired for concealment and protection. Looking *down* on the dark back of a fish it is almost invisible, while to an enemy looking *up* from below the light under-surface would be equally invisible against the light of the clouds and sky. Again, the gorgeous colors of the butterflies which inhabit the depths of tropical forests bear no relation to the kind of light that falls upon them, coming as it does almost wholly from green foliage, dark-brown soil or blue sky; and the bright under-wings of many moths which are

only exposed at night contrast remarkably with the sombre tints of the upper-wings which are more or less exposed to the various colors of surrounding Nature.

We find, then, that neither the general influence of solar light and heat, nor the special action of variously-tinted rays, are adequate causes for the wonderful variety, intensity, and complexity of the colors that everywhere meet us in the animal and vegetable world. Let us, therefore, take a wider view of these colors, grouping them into classes determined by what we know of their actual uses or special relations to the habits of their possessors. This, which may be termed the functional or biological classification of the colors of living organisms, seems to be best expressed by a division into five groups as follows:

Animals.
1. Protective colors.
2. Warning colors.
   a. Of creatures specially protected.
   b. Of defenseless creatures, mimicking *a*.
3. Sexual colors.
4. Typical colors.

Plants....
5. Attractive colors.

The nature of the first two groups, protective and warning colors, has been so fully detailed and illustrated in my chapter on "Mimicry and other Protective Resemblances among Animals" ("Contributions to the Theory of Natural Selection," page 45), that very little need be added here except a few words of general explanation. Protective colors are exceedingly prevalent in Nature, comprising those of all the white arctic animals, the sandy-colored desert forms, and the green birds and insects of tropical forests. It also comprises thousands of cases of special resemblance—of birds to the surroundings of their nests, and especially of insects to the bark, leaves, flowers, or soil, on or amid which they dwell. Mammalia, fishes, and reptiles, as well as mollusca and other marine invertebrates, present similar phenomena; and the more the habits of animals are investigated, the more numerous are found to be the cases in which their colors tend to conceal them, either from their enemies or from the creatures they prey upon. One of the last-observed and most curious of these protective resemblances has been communicated to me by Sir Charles Dilke. He was shown in Java a pink-colored *mantis*, which, when at rest, exactly resembled a pink orchis-flower. The mantis is a carnivorous insect which lies in wait for its prey, and by its resemblance to a flower the insects it feeds on would be actually attracted toward it. This one is said to feed especially on butterflies, so that it is really a living trap and forms its own bait! All who have observed animals, and especially insects, in their native haunts and attitudes, can understand how it is that an insect which in a cabinet looks exceedingly conspicuous may yet, when alive in its peculiar attitude of repose and with its habitual surroundings, be perfectly well concealed. We can hardly ever tell, by the mere inspection of an animal, whether its colors are protective or not. No one would imagine the exquisitely beautiful caterpillar of the emperor-moth, which is green with pink, star-like spots, to be protectively colored; yet when feeding on the heather it so harmonizes with the foliage and flowers as to be almost invisible. Every day fresh cases of protective coloring are being discovered even in our own country, and it is becoming more and more evident that the need of protection has played a very important part in determining the actual coloration of animals.

The second class—the warning colors—are exceedingly interesting, because the object and effect of these is, not to conceal the object, but to make it conspicuous. To these creatures it is *useful* to be seen and recognized, the reason being that they have a means of defense which, if known, will prevent their enemies from attacking them, though it is generally not sufficient to save their lives if they are actually attacked. The best examples of these specially protected creatures consist of two extensive families of butterflies, the Danaidæ and Acræidæ, comprising many hundreds of species inhabiting the tropics of all parts of the world. These insects are generally large, are all conspicuously and often most gorgeously colored, presenting almost every conceivable tint and pattern; they all fly slowly, and they never attempt to conceal themselves; yet no bird, spider, lizard, or monkey (all of which eat other butterflies), ever touches them. The reason simply is that they are not fit to eat, their juices having a powerful odor and taste that is absolutely disgusting to all these animals. Now, we see the reason of their showy colors and slow flight. It is good for them to be seen and recognized, for then they are never molested; but if they did not differ in form and coloring from other butterflies, or if they flew so quickly that their peculiarities could not be easily noticed, they would be captured, and though not eaten would be maimed or killed. As soon as the cause of the peculiarities of these butterflies was recognized, it was seen that the same explana-

tion applied to many other groups of animals. Thus bees and wasps and other stinging insects are showily and distinctively colored; many soft and apparently defenseless beetles, and many gay-colored moths, were found to be as nauseous as the above-named butterflies; other beetles, whose hard and glossy coats-of-mail render them unpalatable to insect-eating birds, are also sometimes showily colored; and the same rule was found to apply to caterpillars, all the brown and green (or protectively-colored species) being greedily eaten by birds, while showy kinds which never hide themselves—like those of the magpie-, mullein-, and burnet-moths—were utterly refused by insectivorous birds, lizards, frogs, and spiders ("Contributions to Theory of Natural Selection," page 117). Some few analogous examples are found among vertebrate animals. I will only mention here a very interesting case not given in my former work. In his delightful book entitled "The Naturalist in Nicaragua," Mr. Belt tells us that there is in that country a frog which is very abundant, which hops about in the daytime, which never hides himself, and which is gorgeously colored with red and blue. Now, frogs are usually green, brown, or earth-colored, feed mostly at night, and are all eaten by snakes and birds. Having full faith in the theory of protective and warning colors, to which he had himself contributed some valuable facts and observations, Mr. Belt felt convinced that this frog must be uneatable. He therefore took one home, and threw it to his ducks and fowls; but all refused to touch it except one young duck, which took the frog in its mouth, but dropped it directly, and went about jerking its head as if trying to get rid of something nasty. Here the uneatableness of the frog was predicted from its colors and habits, and we can have no more convincing proof of the truth of the theory than such previsions.

The universal avoidance by carnivorous animals of all these specially protected groups, which are thus entirely free from the constant persecution suffered by other creatures not so protected, would evidently render it advantageous for any of these latter which were subjected to extreme persecution to be mistaken for the former, and for this purpose it would be necessary that they should have the same colors, form, and habits. Strange to say, wherever there is an extensive group of directly protected forms (division *a* of animals with warning colors), there are sure to be found a few otherwise defenseless creatures which resemble them externally so as to be mistaken for them, and which thus gain protection as it were on false pretenses (division *b* of animals with warning colors). This is what is called "mimicry," and it has already been very fully treated of by Mr. Bates (its discoverer), by myself, by Mr. Trimen, and others. Here it is only necessary to state that the uneatable Danaidæ and Acræidæ are accompanied by a few species of other groups of butterflies (Leptalidæ, Papilios, Diademas, and Moths) which are all really eatable, but which escape attack by their close resemblance to some species of the uneatable groups found in the same locality. In like manner there are a few eatable beetles which exactly resemble species of uneatable groups; and others, which are soft, imitate those which are uneatable through their hardness. For the same reason wasps are imitated by moths, and ants by beetles; and even poisonous snakes are mimicked by harmless snakes, and dangerous hawks by defenseless cuckoos. How these curious imitations have been brought about, and the laws which govern them, have been discussed in the work already referred to.

The third class—sexual colors—comprise all cases in which the colors of the two sexes differ. This difference is very general, and varies greatly in amount, from a slight divergence of tint up to a radical change of coloration. Differences of this kind are found among all classes of animals in which the sexes are separated, but they are much more frequent in some groups than in others. In mammalia, reptiles, and fishes, they are comparatively rare and not great in amount, whereas among birds they are very frequent and very largely developed. So among insects, they are abundant in butterflies, while they are comparatively uncommon in beetles, wasps, and hemiptera.

The phenomena of sexual variations of color, as well as of color generally, are wonderfully similar in the two analogous yet totally unrelated groups of birds and butterflies; and, as they both offer ample materials, we shall confine our study of the subject chiefly to them. The most common case of difference of color between the sexes is for the male to have the same general hue as the females, but deeper and more intensified; as in many thrushes, finches, and hawks; and among butterflies in the majority of our British species. In cases where the male is smaller the intensification of color is especially well pronounced, as in many of the hawks and falcons, and in most butterflies and moths in which the coloration does not materially differ. In another extensive

series we have spots or patches of vivid color in the male which are represented in the female by far less brilliant tints or are altogether wanting; as exemplied in the gold-crest warbler, the green woodpecker, and most of the orange-tip butterflies (*Anthocharis*). Proceeding with our survey we find greater and greater differences of color in the sexes, till we arrive at such extreme cases as some of the pheasants, the chatterers, tanagers, and birds-of-paradise, in which the male is adorned with the most gorgeous and vivid colors, while the female is usually dull brown, or olive-green, and often shows no approximation whatever to the varied tints of her partner. Similar phenomena occur among butterflies; and in both these classes there are also a considerable number of cases in which both sexes are highly colored in a different way. Thus many woodpeckers have the head in the male red, in the female yellow; while some parrots have red spots in the male, replaced by blue in the female, as in *Psittacula diopthalma*. In many South American papilios green spots on the male are represented by red on the female; and in several species of the genus *Epicalia* orange bands in the male are replaced by blue in the female, a similar change of color as in the small parrot above referred to. For fuller details of the varieties of sexual coloration we refer our readers to Mr. Darwin's "Descent of Man," chapters x. to xviii., and to chapters iii., iv., and vii., of my "Contributions to the Theory of Natural Selection."

The fourth group—of typically-colored animals—includes all species which are brilliantly or conspicuously colored in both sexes, and for whose particular colors we can assign no function or use. It comprises an immense number of showy birds, such as kingfishers, barbets, toucans, lories, tits, and starlings; among insects most of the largest and handsomest butterflies, innumerable bright-colored beetles, locusts, dragon-flies, and hymenoptera; a few mammalia, as the zebras; a great number of marine fishes; thousands of striped and spotted caterpillars; and abundance of mollusca, starfish, and other marine animals. Among these we have included some which, like the gaudy caterpillars, have warning colors; but as that theory does not explain the particular colors or the varied patterns with which they are adorned, it is best to include them also in this class. It is a suggestive fact that all the brightly-colored birds mentioned above build in holes or form covered nests, so that the females do not need that protection during the breeding-season, which I believe to be one of the chief causes of the dull color of female birds when their partners are gayly colored. This subject is fully argued in my "Contributions," etc., chapter vii.

As the colors of plants and flowers are very different from those of animals, both in their distribution and functions, it will be well to treat them separately: we will therefore now consider how the general facts of color here sketched out can be explained. We have first to inquire what is color, and how it is produced; what is known of the causes of change of color; and what theory best accords with the whole assemblage of facts.

The sensation of color is caused by vibrations or undulations of the ethereal medium of different lengths and velocities. The whole body of vibrations caused by the sun is termed radiation, and consists of sets of waves which vary considerably in their dimensions and their rate of vibration, but of which the middle portion only is capable of exciting in us sensations of light and color. Beginning with the largest and slowest rays or wave-vibrations, we have first those which produce heat-sensations only; as they get smaller and quicker, we perceive a dull-red color; and as the waves increase in rapidity of vibration and diminish in size, we get successively sensations of orange, yellow, green, blue, indigo, and violet, all fading imperceptibly into each other. Then come more invisible rays, of shorter wave-length and quicker vibration, which produce, solely or chiefly, chemical effects. The red rays, which first become visible, have been ascertained to vibrate at the rate of 458 millions of millions of times in a second, the length of each wave being $\frac{1}{36900}$ of an inch; while the violet rays, which last remain visible, vibrate 727 millions of millions of times per second, and have a wave-length of $\frac{1}{64516}$ of an inch. Although the waves vibrate at different rates, they are all propagated through the ether with the same velocity (192,000 miles per second), just as different musical sounds, which are produced by waves of *air* of different lengths and rates of vibration, travel at the same rate, so that a tune played several hundred yards off reaches the ear in correct time. There are, therefore, an almost infinite number of different color-producing vibrations, and these may be combined in an almost infinite variety of ways, so as to excite in us the sensation of all the varied colors and tints we are capable of perceiving. When all the different kinds of rays reach us in the proportion in which they exist in the light of the sun, they produce the sensation of white. If the rays which excite the sensation of any one

color are prevented from reaching us, the remaining rays in combination produce a sensation of color often very far removed from white. Thus green rays being abstracted leave purple light; blue, orange-red light; violet, yellowish-green light, and so on. These pairs are termed complementary colors. And if portions of differently colored lights are abstracted in various degrees, we have produced all those infinite gradations of colors, and all those varied tints and hues, which are of such use to us in distinguishing external objects, and which form one of the great charms of our existence. Primary colors would therefore be as numerous as the different wave-lengths of the visible radiations if we could appreciate all their differences, while secondary or compound colors caused by the simultaneous action of any combination of rays of different wave-lengths must be still more numerous. In order to account for the fact that all colors appear to us capable of being produced by combinations of three primary colors—red, green, and violet—it is believed that we have three sets of nerve-fibres in the retina, each of which is capable of being excited by all rays, but that one set is excited most by the larger or red waves, another by the medium or green waves, and the third set chiefly by the violet or small waves of light; and when all three sets are excited together in proper proportions we see white. This view is supported by the phenomena of color-blindness, which are explicable on the theory that one of these sets of nerve-fibres (usually that adapted to perceive red) has lost its sensibility, causing all colors to appear as if the red rays were abstracted from them. It is another property of these various radiations that they are unequally refracted or bent in passing obliquely through transparent bodies, the longer waves being least refracted, the shorter most. Hence it becomes possible to analyze white or any other light into its component rays; a small ray of sunlight, for example, which would produce a round white spot on a wall, if passed through a prism is lengthened out into a band of colored light exactly corresponding to the colors of the rainbow. Any one color can thus be isolated and separately examined, and by means of reflecting mirrors the separate colors can be again compounded in various ways, and the resulting colors observed. This band of colored light is called a *spectrum*, and the instrument by which the *spectra* of various kinds of light are examined is called a *spectroscope*. This branch of the subject has, however, no direct bearing on the mode in which the colors of living things are produced, and it has only been alluded to in order to complete our sketch of the nature of color.

The colors which we perceive in material substances are produced either by the absorption or by the interference of some of the rays which form white light. Pigmental or absorption colors are the most frequent, comprising all the opaque tints of flowers and insects, and all the colors of dyes and pigments. They are caused by rays of certain wave-lengths being absorbed, while the remaining rays are reflected and give rise to the sensation of color. When all the color-producing rays are reflected in due proportion the color of the object is white, when all are absorbed the color is black. If blue rays only are absorbed the resulting color is orange-red; and generally, whatever color an object appears to us, it is because the complementary colors are absorbed by it. The reason why rays of only certain refrangibilities are reflected and the rest of the incident light absorbed by each substance, is supposed to depend upon the molecular structure of the body. Chemical action almost always implies change of molecular structure, hence chemical action is the most potent cause of change of color. Sometimes simple solution in water effects a marvelous change, as in the case of the well-known aniline dyes; the magenta and violet dyes exhibiting, when in the solid form, various shades of golden or bronzy metallic green. Heat, again, often produces change of color, and this without effecting any chemical change. Mr. Ackroyd has recently investigated this subject,[1] and has shown that a large number of bodies are changed by heat, returning to their normal color when cooled, and that this change is almost always in the direction of the less refrangible rays or longer wave-lengths; and he connects the change with molecular expansion caused by heat. As examples may be mentioned mercuric oxide, which is orange-yellow, but which changes to orange, red, and brown, when heated; chromic oxide, which is green, and changes to yellow; cinnabar, which is scarlet, and changes to puce; and metaborate of copper, which is blue, and changes to green and greenish-yellow. The coloring-matters of animals are very varied. Copper has been found in the red of the wing of the turaco, and Mr. Sorby has detected no less than seven distinct coloring-matters in birds'-eggs, several of which are chemically related to those of blood and bile. The same colors are often produced by quite dif-

[1] "Metachromatism, or Color-Change" (*Chemical News*, August, 1876).

ferent substances in different groups, as shown by the red of the wings of the burnet-moth changing to yellow with muriatic acid, while the red of the red-admiral-butterfly undergoes no such change.

These pigmental colors have a different character in animals according to their position in the integument. Following Dr. Hagen's classification, epidermal colors are those which exist in the external chitinized skin of insects, in the hairs of mammals, and, partially, in the feathers of birds. They are often very deep and rich, and do not fade after death. The hypodermal colors are those which are situated in the inferior soft layer of the skin. These are often of lighter and more vivid tints, and usually fade after death. Many of the reds and yellows of butterflies and birds belong to this class, as well as the intensely vivid hues of the naked skin about the heads of many birds. These colors sometimes exude through the pores, forming an evanescent bloom on the surface.

Interference colors are less frequent in the organic world. They are caused in two ways: either by reflection from the two surfaces of transparent films, as seen in the soap-bubble and in thin films of oil on water; or by fine striæ, which produce colors either by reflected or transmitted light, as seen in mother-of-pearl, and in finely-ruled metallic surfaces. In both cases color is produced by light of one wave-length being neutralized, owing to one set of such waves being caused to be half a wave-length behind the other set, as may be found explained in any treatise on physical optics. The result is, that the complementary color of that neutralized is seen; and, as the thickness of the film or the fineness of the striæ undergoes slight changes, almost any color can be produced. This is believed to be the origin of many of the glossy or metallic tints of insects, as well as of those of the feathers of some birds. The iridescent colors of the wings of dragon-flies are caused by the superposition of two or more transparent lamellæ; while the shining blue of the purple-emperor and other butterflies, and the intensely metallic colors of humming-birds, are probably due to fine striæ.

This outline sketch of the nature of color in the animal world, however imperfect, will at least serve to show us how numerous and varied are the causes which perpetually tend to the production of color in animal tissues. If we consider that, in order to produce white, all the rays which fall upon an object must be reflected in the same proportions as they exist in solar light, whereas, if rays of any one or more kinds are absorbed or neutralized, the resultant reflected light will be colored, and that this color may be infinitely varied according to the proportions in which different rays are reflected or absorbed, we should expect that white would be, as it really is, comparatively rare and exceptional in Nature. The same observation will apply to black, which arises from the absorption of all the different rays. Many of the complex substances which exist in animals and plants are subject to changes of color under the influence of light, heat, or chemical change, and we know that chemical changes are continually occurring during the physiological processes of development and growth. We also find that every external character is subject to minute changes, which are generally perceptible to us in closely allied species; and we can therefore have no doubt that the extension and thickness of the transparent lamellæ, and the fineness of the striæ or rugosities of the integuments, must be undergoing constant minute changes; and these changes will very frequently produce changes of color. These considerations render it probable that color is a normal and even necessary result of the complex structure of animals and plants, and that those parts of an organism which are undergoing continual development and adaptation to new conditions, and are also continually subject to the action of light and heat, will be the parts in which changes of color will most frequently appear. Now, there is little doubt that the external changes of animals and plants in adaptation to the environment are much more numerous than the internal changes, as seen in the varied character of the integuments and appendages of animals—hair, horns, scales, feathers, etc.—and in plants, the leaves, bark, flowers, and fruit, with their various appendages —compared with the comparative uniformity of the texture and composition of their internal tissues; and this accords with the uniformity of the tints of blood, muscle, nerve, and bone, throughout extensive groups, as compared with the great diversity of color of their external organs. It seems a fair conclusion that color *per se* may be considered to be normal, and to need no special accounting for, while the absence of color (that is, either *white* or *black*), or the prevalence of certain colors to the constant exclusion of others, must be traced, like other modifications in the economy of living things, to the needs of the species. Or, looking at it in another aspect, we may say that amid the constant variations of animals and plants color is ever tending to vary

and to appear where it is absent, and that natural selection is constantly eliminating such tints as are injurious to the species, or preserving and intensifying such as are useful.

This view is in accordance with the well-known fact of colors which rarely or never appear in the species in a state of nature continually occurring among domesticated animals and cultivated plants; showing us that the capacity to develop color is ever present, so that almost any required tint can be produced which may, under changed conditions, be useful, in however small a degree.

Let us now see how these principles will enable us to understand and explain the varied phenomena of color in Nature, taking them in the order of our functional classification of colors (page 527).

Theory of Protective Colors.—We have seen that obscure or protective tints in their infinitely varied degrees are present in every part of the animal kingdom, whole families or genera being often thus colored. Now, the various brown, earthy, ashy, and other neutral tints, are those which would be most readily produced, because they are due to an irregular mixture of many kinds of rays; while pure tints require either rays of one kind only, or definite mixtures in proper proportions of two or more kinds of rays. This is well exemplified by the comparative difficulty of producing definite pure tints by the mixture of two or more pigments, while a hap-hazard mixture of a number of these will be almost sure to produce browns, olives, or other neutral or dirty colors. An indefinite or irregular absorption of some rays and reflection of others would, therefore, produce obscure tints; while pure and vivid colors would require a perfectly definite absorption of one portion of the colored rays, leaving the remainder to produce the true complementary color. This being the case we may expect these brown tints to occur when the need of protection is very slight or even when it does not exist at all, always supposing that bright colors are not in any way useful to the species. But whenever a pure color is protective, as green in tropical forests, or white among arctic snows, there is no difficulty in producing it, by natural selection acting on the innumerable slight variations of tint which are ever occurring. Such variations may, as we have seen, be produced in a great variety of ways, either by chemical changes in the secretions or by molecular changes in surface-structure, and may be brought about by change of food, by the photographic action of light, or by the normal process of generative variation. Protective colors, therefore, however curious and complex they may be in certain cases, offer no real difficulties.

Theory of Warning Colors.—These differ greatly from the last class, inasmuch as they present us with a variety of brilliant hues, often of the greatest purity, and combined in striking contrasts and conspicuous patterns. Their use depends upon their boldness and visibility, not on the presence of any one color; hence we find among these groups some of the most exquisitely-colored objects in Nature. Many of the uneatable caterpillars are strikingly beautiful; while the Danaidæ, Heliconidæ, and protected groups of Papilionidæ, comprise a series of butterflies of the most brilliant and contrasted colors. The bright colors of many of the sea-anemones and sea-slugs will probably be found to be in this sense protective, serving as a warning of their uneatableness. On our theory none of these colors offer any difficulty. Conspicuousness being useful, every variation tending to brighter and purer colors was selected, the result being the beautiful variety and contrast we find.

But when we come to those groups which gain protection solely by being mistaken for some of these brilliantly colored but uneatable creatures, a difficulty really exists, and to many minds is so great as to be insuperable. It will be well, therefore, to endeavor to explain how the resemblance in question may have been brought about. The most difficult case, which may be taken as a type of the whole, is that of the genus *Leptalis* (a group of South American butterflies allied to our common white and yellow kinds), many of the larger species of which are still white or yellow, and which are all eatable by birds and other insectivorous creatures. But there are also a number of species of *Leptalis* which are brilliantly red, yellow, and black, and which, band for band and spot for spot, resemble some one of the Danaidæ or Heliconidæ which inhabit the same district, and which are nauseous and uneatable. Now, the common objection is, that a slight approach to one of these protected butterflies would be of no use, while a greater sudden variation is not admissible on the theory of gradual change by indefinite slight variations. This objection depends almost wholly on the supposition that when the first steps toward mimicry occurred, the South American Danaidæ were what they are now, while the ancestors of the Leptalides were like the ordinary white or yellow Pieridæ to which they are allied. But the danaioid butterflies of South

America are so immensely numerous and so greatly varied, not only in color but in structure, that we may be sure they are of vast antiquity and have undergone great modification. A large number of them, however, are still of comparatively plain colors, often rendered extremely elegant by the delicate transparency of the wing-membrane, but otherwise not at all conspicuous. Many have only dusky or purplish bands or spots, others have patches of reddish or yellowish-brown —perhaps the commonest color among butterflies—while a considerable number are tinged or spotted with yellow, also a very common color, and one especially characteristic of the Pieridæ, the family to which *Leptalis* belongs. We may therefore reasonably suppose that in the early stages of the development of the Danaidæ, when they first began to acquire those nauseous secretions which are now their protection, their colors were somewhat plain, either dusky with paler bands and spots, or yellowish with dark borders, and sometimes with reddish bands or spots. At this time they had probably shorter wings and a more rapid flight, just like the other unprotected families of butterflies. But as soon as they became decidedly unpalatable to any of their enemies, it would be an advantage to them to be readily distinguished from all the eatable kinds; and as butterflies were no doubt already very varied in color, while all probably had wings adapted for pretty rapid or jerking flight, the best distinction might have been found in outline and habits; whence would arise the preservation of those varieties whose longer wings, bodies, and antennæ, and slower flight, rendered them noticeable—characters which now distinguish the whole group in every part of the world. Now, it would be at this stage that some of the weaker-flying Pieridæ which happened to resemble some of the Danaidæ around them in their yellow and dusky tints, and in the general outline of their wings, would be sometimes mistaken for them by the common enemy, and would thus gain an advantage in the struggle for existence. Admitting this one step to be made, and all the rest must inevitably follow from simple variation and survival of the fittest. So soon as the nauseous butterfly varied in form or color to such an extent that the corresponding eatable butterfly no longer closely resembled it, the latter would be exposed to attacks, and only those variations would be preserved which kept up the resemblance. At the same time we may well suppose the enemies to become more acute and able to detect smaller differences than at first. This would lead to the destruction of all adverse variations, and thus keep up in continually-increasing complexity the outward mimicry which now so amazes us. During the long ages in which this process has been going on, many a *Leptalis* may have become extinct from not varying sufficiently in the right direction, and at the right time, to keep up a protective resemblance to its neighbor; and this will accord with the comparatively small number of cases of true mimicry as compared with the frequency of those protective resemblances to vegetable or inorganic objects whose forms are less definite and colors less changeable. About a dozen other genera of butterflies and moths mimic the Danaidæ in various parts of the world, and exactly the same explanation will apply to all of them. They represent those species of each group which, at the time when the Danaidæ first acquired their protective secretions, happened outwardly to resemble some of them, and have by concurrent variation, aided by a rigid selection, been able to keep up that resemblance to the present day.[1]

Theory of Sexual Colors.—In Mr. Darwin's celebrated work, "The Descent of Man and Selection in Relation to Sex," he has treated of sexual color in combination with other sexual characters, and has arrived at the conclusion that all, or almost all, the colors of the higher animals (including among these insects and all vertebrates) are due to voluntary sexual selection; and that diversity of color in the sexes is due, primarily, to the transmission of color-variations either to one sex only, or to both sexes, the difference depending on some unknown law, and not being due to natural selection.

I have long held this portion of Mr. Darwin's theory to be erroneous, and have argued that the primary cause of sexual diversity of color was the need of protection, repressing in the female those bright colors which are nominally produced in both sexes by general laws; and I have attempted to explain many of the more difficult cases on this principle ("A Theory of Birds' Nests," in "Contributions," etc., p. 231). As I have since given much thought to this subject, and have arrived at some views which appear to me to be of

[1] For fuller information on this subject the reader should consult Mr. Bates's original paper. "Contributions to an Insect-fauna of the Amazon Valley," in "Transactions of the Linnean Society," vol. xxiii., p. 495; Mr. Trimen's paper in vol. xxvi., p. 497; the author's essay on "Mimicry," etc., already referred to; and, in the absence of collections of butterflies, the plates of Heliconidæ and Leptalidæ, in Hewitson's "Exotic Butterflies," and Felder's "Voyage of the Novara," may be examined.

considerable importance, it will be well to sketch briefly the theory I now hold, and afterward show its application to some of the detailed cases adduced in Mr. Darwin's work.

The very frequent superiority of the male bird or insect in brightness or intensity of color, even when the general tints and coloration are the same, now seems to me to be due to the greater vigor and activity and the higher vitality of the male. The colors of an animal usually fade during disease or weakness, while robust health and vigor add to their intensity. This intensity of coloration is most manifest in the male during the breeding-season, when the vitality is at a maximum. It is also very manifest in those cases in which the male is smaller than the female, as in the hawks and in most butterflies and moths. The same phenomena occur, though in a less marked degree, among mammalia. Whenever there is a difference of color between the sexes the male is the darker or more strongly marked, and difference of intensity is most visible during the breeding-season ("Descent of Man," p. 533). Numerous cases among domestic animals also prove that there is an inherent tendency in the male to special developments of dermal appendages and color, quite independently of sexual or any other form of selection. Thus, "the hump on the male zebu cattle of India, the tail of fat-tailed rams, the arched outline of the forehead in the males of several breeds of sheep, and the mane, the long hairs on the hind-legs, and the dewlap of the male of the Berbura goat," are all adduced by Mr. Darwin as instances of characters peculiar to the male, yet not derived from any parent ancestral form. Among domestic pigeons the character of the different breeds is often most strongly manifested in the male birds; the wattle of the carriers and the eye-wattles of the barbs are largest in the males, and male pouters distend their crops to a much greater extent than do the females, and the cock fantails often have a greater number of tail-feathers than the females. There are also some varieties of pigeons of which the males are striped or spotted with black, while the females are never so spotted ("Animals and Plants under Domestication," I., 161); yet in the parent stock of these pigeons there are no differences between the sexes either of plumage or color, and artificial selection has not been applied to produce them.

The greater intensity of coloration in the male—which may be termed the normal sexual difference—would be further developed by the combats of the males for the possession of the females. The most vigorous and energetic usually being able to rear most offspring, intensity of color, if dependent on or correlated with vigor, would tend to increase. But as differences of color depend upon minute chemical or structural differences in the organism, increasing vigor acting unequally on different portions of the integument, and often producing at the same time abnormal developments of hair, horns, scales, feathers, etc., would almost necessarily lead also to variable distribution of color, and thus to the production of new tints and markings. These acquired colors would, as Mr. Darwin has shown, be transmitted to both sexes or to one only, according as they first appeared at an early age, or in adults of one sex, and thus we may account for some of the most marked differences in this respect. With the exception of butterflies, the sexes are almost alike in the great majority of insects. The same is the case in mammals and reptiles, while the chief departure from the rule occurs in birds, though even here in very many cases the law of sexual likeness prevails. But in all cases where the increasing development of color became disadvantageous to the female, it would be checked by natural selection, and thus produce those numerous instances of protective coloring in the female only which occur in these two groups of animals.

There is also, I believe, a very important purpose and use of the varied colors of the higher animals, in the facility it affords for recognition by the sexes or by the young of the same species; and it is this use which probably fixes and determines the coloration in many cases. When differences of size and form are very slight, color affords the only means of recognition at a distance or while in motion, and such a distinctive character must therefore be of especial value to flying insects which are continually in motion, and encounter each other, as it were, by accident. This view offers us an explanation of the curious fact that among butterflies the females of closely-allied species in the same locality sometimes differ considerably, while the males are much alike; for as the males are the swiftest and the highest fliers and seek the females, it would evidently be advantageous for them to be able to recognize their true partners at some distance off. This peculiarity occurs with many species of *Papilio*, *Diadema*, *Adolias*, and *Colias*. In birds such marked differences of color are not required, owing to their higher organization and more perfect senses, which render recognition easy by means of a combination of very slight

differential characters. This principle may, perhaps, however, account for some anomalies of coloration among the higher animals. Thus, Mr. Darwin, while admitting that the hare and the rabbit are colored protectively, remarks that the latter, while running to its burrow, is made conspicuous to the sportsman, and no doubt to all beasts of prey, by its upturned white tail. But this very conspicuousness while running away may be useful as a signal and guide to the young, who are thus enabled to escape danger by following the older rabbits, directly and without hesitation, to the safety of the burrow; and this may be the more important from the semi-nocturnal habits of the animal. If this explanation is correct, and it certainly seems probable, it may serve as a warning of how impossible it is, without exact knowledge of the habits of an animal and a full consideration of all the circumstances, to decide that any particular coloration cannot be protective or in any way useful. Mr. Darwin himself is not free from such assumptions. Thus, he says: "The zebra is conspicuously striped, and stripes cannot afford any protection on the open plains of South Africa." But the zebra is a very swift animal, and, when in herds, by no means void of means of defense. The stripes, therefore, *may* be of use by enabling stragglers to distinguish their fellows at a distance, and they *may* be even protective when the animal is at rest among herbage—the only time when it would need protective coloring. Until the habits of the zebra have been observed with special reference to this point, it is surely somewhat hasty to declare that the stripes "cannot afford any protection."

The wonderful display and endless variety of color in which butterflies and birds so far exceed all other animals seem primarily due to the excessive development and endless variations of the integumentary structures. No insects have such widely-expanded wings in proportion to their bodies as butterflies and moths; in none do the wings vary so much in size and form, and in none are they clothed with such a beautiful and highly-organized coating of scales. According to the general principles of the production of color already explained, these long-continued expansions of membranes and developments of surface-structures must have led to numerous color-changes, which have been sometimes checked, sometimes fixed and utilized, sometimes intensified, by natural selection, according to the needs of the animal. In birds, too, we have the wonderful clothing of plumage—the most highly-organized, the most varied, and the most expanded of all dermal appendages. The endless processes of growth and change during the development of feathers, and the enormous extent of this delicately-organized surface, must have been highly favorable to the production of varied color-effects, which, when not injurious, have been merely fixed for purposes of specific identification, but have often been modified or suppressed whenever different tints were needed for purposes of protection.

To voluntary sexual selection, that is, the actual choice by the females of the more brilliantly-colored males, I believe very little if any effect is directly due. It is undoubtedly proved that in birds the females do sometimes exert a choice; but the evidence of this fact collected by Mr. Darwin ("Descent of Man," chapter xiv.) does not prove that color determines that choice, while much of the strongest evidence is directly opposed to this view. All the facts appear to be consistent with the choice depending on a variety of male characteristics, with some of which color is often correlated. Thus it is the opinion of some of the best observers that vigor and liveliness are most attractive, and these are, no doubt, usually associated with intensity of color. Again, the display of the various ornamental appendages of the male during courtship may be attractive; but these appendages, with their bright colors or shaded patterns, are due probably to general laws of growth and to that superabundant vitality which we have seen to be a cause of color. But there are many considerations which seem to show that the possession of these ornamental appendages and bright colors in the male is not an important character functionally, and that it has not been produced by the action of voluntary sexual selection. Amid the copious mass of facts and opinions collected by Mr. Darwin as to the display of color and ornaments by the male birds, there is a total absence of any evidence that the females admire or even notice this display. The hen, the turkey, and the pea-fowl, go on feeding while the male is displaying his finery, and there is reason to believe that it is his persistency and energy rather than his beauty which wins the day. Again, evidence collected by Mr. Darwin himself proves that each bird finds a mate under any circumstances. He gives a number of cases of one of a pair of birds being shot, and the survivor being always found paired again almost immediately. This is sufficiently explained on the assumption that the destruction of birds by various causes is continually leaving widows and widowers in nearly equal proportions, and

thus each one finds a fresh mate; and it leads to the conclusion that permanently-unpaired birds are very scarce; so that, speaking broadly, every bird finds a mate and breeds. But this would almost or quite neutralize any effect of sexual selection of color or ornament, since the less highly-colored birds would be at no disadvantage as regards leaving healthy offspring. If, however, heightened color is correlated with health and vigor, and these healthy and vigorous birds provide best for their young, and leave offspring which, being equally healthy and vigorous, can best provide for themselves, then natural selection becomes a preserver and intensifier of color. Another most important consideration is, that male butterflies rival or even excel the most gorgeous male birds in bright colors and elegant patterns; and among these there is literally not one particle of evidence that the female is influenced by color, or even that she has any power of choice, while there is much direct evidence to the contrary ("Descent of Man," page 318). The weakness of the evidence for sexual selection among these insects is so palpable that Mr. Darwin is obliged to supplement it by the singularly inconclusive argument that "unless the females prefer one male to another, the pairing must be left to mere chance, and this does not appear probable" (*loc. cit.*, page 317). But he has just said, "The males sometimes fight together in rivalry, and many may be seen pursuing or crowding round the same female;" while in the case of the silk-moths, "the females appear not to evince the least choice in regard to their partners." Surely, the plain inference from all this is, that males fight and struggle for the almost passive female, and that the most vigorous and energetic, the strongest-winged or the most persevering, wins her. How can there be chance in this? Natural selection would here act, as in birds, in perpetuating the strongest and most vigorous males, and as these would usually be the more highly-colored of their race, the same results would be produced as regards the intensification and variation of color in the one case as in the other.

Let us now see how these principles will apply to some of the cases adduced by Mr. Darwin in support of his theory of voluntary sexual selection.

In "Descent of Man," second edition, pp. 307–316, we find an elaborate account of the various modes of coloring of butterflies and moths, proving that the colored parts are always more or less displayed, and that they have some evident relation to an observer. Mr. Darwin then says: "From the several foregoing facts it is impossible to admit that the brilliant colors of butterflies, and of some few moths, have commonly been acquired for the sake of protection. We have seen that their colors and elegant patterns are arranged and exhibited as if for display. Hence I am led to believe that the females prefer or are most excited by the more brilliant males; for on any other supposition the males would, as far as we can see, be ornamented to no purpose" (*loc. cit.*, p. 316). I am not aware that any one has ever maintained that the brilliant colors of butterflies have "commonly been acquired for the sake of protection," yet Mr. Darwin has himself referred to cases in which the brilliant color is so placed as to serve for protection; as, for example, the eye-spots on the hind-wings of moths, which are pierced by birds, and so save the vital parts of the insect, while the bright patch on the orange-tip butterflies, which Mr. Darwin denies are protective, may serve the same purpose. It is, in fact, somewhat remarkable how very generally the black spots, ocelli, or bright patches of color, are on the tips, margins, or disks of the wings; and, as the insects are necessarily visible while flying, and this is the time when they are most subject to attacks by insectivorous birds, the position of the more conspicuous parts at some distance from the body may be a real protection to them. Again, Mr. Darwin admits that the white color of the male ghost-moth may render it more easily seen by the female while flying about in the dusk, and if to this we add that it will be also more readily distinguished from allied species, we have a reason for diverse ornamentation in these insects quite sufficient to account for most of the facts, without believing in the selection of brilliant males by the females, for which there is not a particle of evidence. The facts given to show that butterflies and other insects can distinguish colors and are attracted by colors similar to their own, are quite consistent with the view that color, which continually tends to appear, is utilized for purposes of identification and distinction, when not required to be modified or suppressed for purposes of protection. The cases of the females of some species of *Thecla*, *Callidryas*, *Colias*, and *Hipparchia*, which have more conspicuous markings than the male, may be due to several causes: to obtain greater distinction from other species, for protection from birds, as in the case of the yellow-under-wing moths, while sometimes—as in *Hipparchia*—the lower intensity of coloring in the

female may lead to more contrasted markings. Mr. Darwin thinks that here the males have selected the more beautiful females, although one chief fact in support of his theory of voluntary sexual selection is, that throughout the whole animal kingdom the males are usually so ardent that they will accept any female, while the females are coy, and choose the handsomest males, whence it is believed the general brilliancy of males as compared with females has arisen.

Perhaps the most curious cases of sexual difference of color are those in which the female is very much more gayly colored than the male. This occurs most strikingly in some species of *Pieris* in South America, and of *Diadema* in the Malay islands, and in both cases the females resemble species of the uneatable Danaidæ and Heliconidæ, and thus gain a protection. In the case of *Pieris pyrrha*, *P. malenka*, and *P. lorena*, the males are plain white and black, while the females are orange, yellow, and black, and so banded and spotted as exactly to resemble species of Heliconidæ. Mr. Darwin admits that these females have acquired these colors as a protection; but as there is no apparent cause for the strict limitation of the color to the female, he believes that it has been kept down in the male by its being *unattractive* to her. This appears to me to be a supposition opposed to the whole theory of sexual selection itself. For this theory is, that minute variations of color in the male are *attractive* to the female, have always been selected, and that thus the brilliant male colors have been produced. But in this case he thinks that the female butterfly had a constant aversion to every trace of color, even when we must suppose it was constantly recurring during the successive variations which resulted in such a marvelous change in herself. But if we consider the fact that the females frequent the forests where the Heliconidæ abound, while the males fly much in the open, and assemble in great numbers with other white and yellow butterflies on the banks of rivers, may it not be possible that the appearance of orange stripes or patches would be as injurious to the male as it is useful to the female, by making him a more easy mark for insectivorous birds among his white companions? This seems a more probable supposition than the altogether hypothetical choice of the female, sometimes exercised in favor of and sometimes against every new variety of color in her partner.

The full and interesting account given by Mr. Darwin of the colors and habits of male and female birds ("Descent of Man," chapters xiii. and xiv.) proves that in most, if not in all, cases the male birds fully display their ornamental plumage before the females, and in rivalry with each other; but on the essential point of whether the female's choice is determined by minute differences in these ornaments or in their colors, there appears to be an entire absence of evidence. In the section on "Preference for Particular Males by the Females," the facts quoted show indifference to color, except that some color similar to their own seems to be preferred. But in the case of the hen-canary, who chose a greenfinch in preference to either chaffinch or goldfinch, gay colors had evidently no preponderating attraction. There is some evidence adduced that female birds may, and probably do, choose their mates, but none whatever that the choice is determined by difference of color; and no less than three eminent breeders informed Mr. Darwin that they "did not believe that the females prefer certain males on account of the beauty of their plumage." Again, Mr. Darwin himself says, "As a general rule, color appears to have little influence on the pairing of pigeons." The oft-quoted case of Sir R. Heron's peahens which preferred an "old pied cock" to those normally colored, is a very unfortunate one, because pied birds are just those that are not favored in a state of nature, or the breeds of wild birds would become as varied and mottled as our domestic varieties. If such irregular fancies were not rare exceptions, the production of definite colors and patterns by the choice of the female birds, or in any other way, would be impossible.

We now come to such wonderful developments of plumage and color as are exhibited by the peacock and the Argus-pheasant; and I may here mention that it was the case of the latter bird, as fully discussed by Mr. Darwin, which first shook my belief in "sexual," or more properly "female," selection. The long series of gradations, by which the beautifully-shaded ocelli on the secondary wing-feathers of this bird have been produced, are clearly traced out, the result being a set of markings so exquisitely shaded as to represent "balls lying loose within sockets"—purely artificial objects of which these birds could have no possible knowledge. That this result should have been attained through thousands and tens of thousands of female birds all preferring those males whose markings varied slightly in this one direction, this uniformity of choice continuing through thousands and tens of thousands of generations, is to me absolutely in-

credible. And when, further, we remember that those which did not so vary would also, according to all the evidence, find mates and leave offspring, the actual result seems quite impossible of attainment by such means.

Without pretending to solve completely so difficult a problem, I would point out a circumstance which seems to afford a clew. It is, that the most highly-colored and most richly-varied markings occur on those parts of the plumage which have undergone the greatest modification, or have acquired the most abnormal development. In the peacock the tail-coverts are enormously developed, and the "eyes" are situated on the greatly-dilated ends. In the birds-of-paradise, breast, or neck, or head, or tail feathers are greatly developed and highly colored. The hackles of the cock and the scaly breasts of humming-birds are similar developments; while in the Argus-pheasant the secondary quills are so enormously lengthened and broadened as to have become almost useless for flight. Now, it is easily conceivable that, during this process of development, inequalities in the distribution of color may have arisen in different parts of the same feather, and that spots and bands may thus have become broadened out into shaded spots or ocelli, in the way indicated by Mr. Darwin, much as the spots and rings on a soap-bubble increase with increasing tenuity. This is the more probable, as in domestic fowls varieties tend to become symmetrical, quite independently of sexual selection.—("Descent of Man," p. 424.)

If, now, we accept the evidence of Mr. Darwin's most trustworthy correspondents that the choice of the female, so far as she exerts any, falls upon the "most vigorous, defiant, and mettlesome male," and if we further believe, what is certainly the case, that these are, as a rule, the most brightly colored and adorned with the finest developments of plumage, we have a real and not an hypothetical cause at work. For these most healthy, vigorous, and beautiful males will have the choice of the finest and most healthy females, will have the most numerous and healthy families, and will be able best to protect and rear those families. Natural selection, and what may be termed male selection, will tend to give them the advantage in the struggle for existence, and thus the fullest plumage and the finest colors will be transmitted, and tend to advance in each succeeding generation.

There remains, however, what Mr. Darwin evidently considers his strongest argument—the display by the male of each species of its peculiar beauties of plumage and color. We have here, no doubt, a very remarkable and very interesting fact; but this, too, may be explained by general principles, quite independent of any choice or volition of the female bird. During pairing-time the male bird is in a state of great excitement, and full of exuberant energy. Even unornamented birds flutter their wings or spread them out, erect their tails or crests, and thus give vent to the nervous excitability with which they are overcharged. It is not improbable that crests and other erectile feathers may be primarily of use in frightening away enemies, since they are generally erected when angry or during combat. Those individuals who were most pugnacious and defiant, and who brought these erectile plumes most frequently and most powerfully into action, would tend to increase them by use, and to leave them further developed in some of their descendants. If, in the course of this development, color appeared, we have every reason to believe it would be most vivid in these most pugnacious and energetic individuals, and as these would always have the advantage in the rivalry for mates (to which advantage the excess of color and plumage might sometimes conduce), there seems nothing to prevent a progressive development of these ornaments in *all dominant races*, that is, wherever there was such a surplus of vitality, and such complete adaptation to conditions, that the inconvenience or danger produced by them was so comparatively small as not to affect the superiority of the race over its nearest allies. If, then, those portions of the plumage which were originally erected and displayed became developed and colored, the actual display, under the influence of jealousy or sexual excitement, becomes intelligible. The males, in their rivalry with each other, would see what plumes were most effective, and each would endeavor to excel his enemy as far as voluntary exertion could effect it, just as they endeavor to rival each other in song, even sometimes to the point of causing their own destruction.

There is also a general argument against Mr. Darwin's views on this question, founded on the nature and potency of "natural" as opposed to "sexual" selection, which appears to me to be itself almost conclusive of the whole matter at issue. Natural selection, or the survival of the fittest, acts perpetually and on an enormous scale. Taking the offspring of each pair of birds as, on the average, only six annually, one-third of these at most will be preserved, while the two-thirds

which are least fitted will die. At intervals of a few years, whenever unfavorable conditions occur, five-sixths, nine-tenths, or even a greater proportion of the whole yearly production are weeded out, leaving only the most perfect and best adapted to survive. Now, unless these survivors are on the whole the most ornamental, this rigid selective power must neutralize and destroy any influence that may be exerted by female selection. For the utmost that can be claimed for this is, that a small fraction of the least ornamented do not obtain mates, while a few of the most ornamented may leave more than the average number of offspring. Unless, therefore, there is the strictest correlation between ornament and general perfection, the former can have no permanent advantage; and if there is (as I maintain) such a correlation, then the sexual selection of ornament for which there is little or no evidence becomes needless, because natural selection, which is an admitted *vera causa*, will itself produce all the results. In the case of butterflies the argument becomes even stronger, because the fertility is so much greater, and the weeding out of the unfit takes place, to a great extent, in the egg and larva state. Unless the eggs and larvæ which escaped to produce the next generation were those which would produce the more highly-colored butterflies, it is difficult to perceive how the slight preponderance of color sometimes selected by the females should not be wholly neutralized by the extremely rigid selection for other qualities to which the offspring in every stage are exposed. The only way in which we can account for the observed facts is, by the supposition that color and ornament are strictly correlated with health, vigor, and general fitness to survive. We have shown that there is reason to believe that this is the case, and, if so, voluntary sexual selection becomes as unnecessary as it would certainly be ineffective.

There is one other very curious case of sexual coloring among birds—that, namely, in which the female is decidedly brighter or more strongly marked than the male; as in the fighting quails (*Turnix*), painted snipe (*Rhynchæa*), two species of phalarope (*Phalaropus*), and the common cassowary (*Casuarius galeatus*). In all these cases, it is known that the males take charge of and incubate the eggs, while the females are almost always larger and more pugnacious. In my "Theory of Birds' Nests" ("Natural Selection," page 251), I imputed this difference of color to the greater need for protection by the male bird while incubating, to which Mr. Darwin has objected that the difference is not sufficient, and is not always so distributed as to be most effective for this purpose, and he believes that it is due to reversed sexual selection, that is, to the female taking the usual *rôle* of the male, and being chosen for her brighter tints. We have already seen reason for rejecting this latter theory in every case, and I also admit that my theory of protection is, in this case, only partially if at all applicable. But the general theory of intensity of color being due to general vital energy is quite applicable; and the fact that the superiority of the female in this respect is quite exceptional, and is therefore probably not of very ancient date in any one case, will account for the difference of color thus produced being always comparatively slight.

Theory of Typical Colors.—The remaining kinds of animal colors—those which can neither be classed as protective, warning, nor sexual—are for the most part readily explained on the general principles of the development of color which we have now laid down. It is a most suggestive fact that, in cases where color is required only as a warning, as among the uneatable caterpillars, we find, not one or two glaring tints only, but every kind of color disposed in elegant patterns, and exhibiting almost as much variety and beauty as among insects and birds. Yet here, not only is sexual selection out of the question, but the need for recognition and identification by others of the same species seems equally unnecessary. We can then only impute this variety to the normal production of color in organic forms, when fully exposed to light and air and undergoing great and rapid developmental modification. Among more perfect animals, where the need for recognition has been added, we find intensity and variety of color at its highest pitch among the South American butterflies of the families Heliconidæ and Danaidæ, as well as among the Nymphalidæ and Erycinidæ, many of which obtain the necessary protection in other ways. Among birds also, wherever the habits are such that no special protection is needed for the females, and where the species frequent the depths of tropical forests and are thus naturally protected from the swoop of birds of prey, we find almost equally intense coloration; as in the trogons, barbets, and gapers.

Of the mode of action of the general principles of color-development among animals, we have an excellent example in the humming-birds. Of all birds these are at once the smallest, the most active, and the fullest of vital energy. When poised in the air, their wings are invisible, owing

to the rapidity of their motion, and when startled they dart away with the rapidity of a flash of light. Such active creatures would not be an easy prey to any rapacious bird; and if one at length was captured, the morsel obtained would hardly repay the labor. We may be sure, therefore, that they are practically unmolested. The immense variety they exhibit in structure, plumage, and color, indicates a high antiquity for the race, while their general abundance in individuals shows that they are a dominant group, well adapted to all the conditions of their existence. Here we find everything necessary for the development of color and accessory plumes. The surplus vital energy shown in their combats and excessive activity has expended itself in ever-increasing developments of plumage, and greater and greater intensity of color, regulated only by the need for specific identification which would be especially required in such small and mobile creatures. Thus may be explained those remarkable differences of color between closely-allied species, one having a crest like the topaz, while in another it resembles the sapphire. The more vivid colors and more developed plumage of the males, I am now inclined to think, may be wholly due to their greater vital energy, and to those general laws which lead to such superior developments even in domestic breeds; but in some cases the need of protection by the female while incubating, to which I formerly imputed the whole phenomenon, may have suppressed a portion of the ornament which she would otherwise have attained.

Another real though as yet inexplicable cause of diversity of color is to be found in the influence of locality. It is observed that species of totally distinct groups are colored alike in one district, while in another district the allied species all undergo the same change of color. Cases of this kind have been adduced by Mr. Bates, by Mr. Darwin, and by myself, and I have collected all the more curious and important examples in my "Address to the Biological Section of the British Association" at Glasgow in 1876. The most probable cause for these simultaneous variations would seem to be the presence of peculiar elements or chemical compounds in the soil, the water, or the atmosphere, or of special organic substances in the vegetation; and a wide field is thus offered for chemical investigation in connection with this interesting subject. Yet, however we may explain it, the fact remains, of the same vivid colors in definite patterns being produced in quite unrelated groups, which only agree, so far as we yet know, in inhabiting the same locality.

Let us now sum up the conclusion at which we have arrived, as to the various modes in which color is produced or modified in the animal kingdom.

The various causes of color in the animal world are, molecular and chemical change of the substance of their integuments, or the action on it of heat, light, or moisture. It is also produced by interference of light in superposed transparent lamellæ, or by excessively fine surface striæ. These elementary conditions for the production of color are found everywhere in the surface-structures of animals, so that its presence must be looked upon as normal, its absence as exceptional.

Colors are fixed or modified in animals by natural selection for various purposes: obscure or imitative colors for concealment—gaudy colors as a warning—and special markings either for easy recognition by strayed individuals females, or young, or to direct attack from a vital part, as in the large, brilliantly-marked wings of some butterflies and moths.

Colors are produced or intensified by processes of development—either where the integument or its appendages undergo great extension or modification, or where there is a surplus of vital energy, as in male animals generally, and more especially at the breeding-season.

Colors are also more or less influenced by a variety of causes, such as the nature of the food, the photographic action of light, and also by some unknown local action probably dependent on chemical peculiarities in the soil or vegetation.

These various causes have acted and reacted in a variety of ways, and have been modified by conditions dependent on age or on sex, on competition with new forms, or on geographical or climatic changes. In so complex a subject, for which experiment and systematic inquiry have done so little, we cannot expect to explain every individual case, or solve every difficulty; but it is believed that all the great features of animal coloration and many of the details become explicable on the principles we have endeavored to lay down.

It will perhaps be considered presumptuous to put forth this sketch of the subject of color in animals, as a substitute for one of Mr. Darwin's most highly elaborated theories—that of voluntary or perceptive sexual selection; yet I venture to think that it is more in accordance with the whole of the facts, and with the theory of natural selection itself: and I would ask such of my readers as may be sufficiently interested in the subject to read again chapters xi. to xvi. of

the "Descent of Man," and consider the whole theory from the point of view here laid down. The explanation of almost all the ornaments and colors of birds and insects as having been produced by the perceptions and choice of the females has, I believe, staggered many evolutionists, but has been provisionally accepted because it was the only theory that even attempted to explain the facts. It may perhaps be a relief to some of them, as it has been to myself, to find that the phenomena can be shown to depend on the general laws of development, and on the action of "natural selection," which theory will, I venture to think, be relieved from an abnormal excrescence, and gain additional vitality by the adoption of my view of the subject.

Although we have arrived at the conclusion that tropical light and heat can in no sense be considered the cause of color, there remains to be explained the undoubted fact that all the more intense and gorgeous tints are manifested by the animal life of the tropics, while in some groups, such as butterflies and birds, there is a marked preponderance of highly-colored species. This is probably due to a variety of causes, some of which we can indicate, while others remain to be discovered. The luxuriant vegetation of the tropics throughout the entire year affords so much concealment, that color may there be safely developed to a much greater extent than in climates where the trees are bare in winter, during which season the struggle for existence is most severe, and even the slightest disadvantage may prove fatal. Equally important, probably, has been the permanence of favorable conditions in the tropics, allowing certain groups to continue dominant for long periods, and thus to carry out in one unbroken line whatever developments of plumage or color may once have acquired an ascendency. Changes of climatal conditions, and preëminently the Glacial epoch, probably led to the extinction of a host of highly-developed and finely-colored insects and birds in temperate zones, just as we know that it led to the extinction of the larger and more powerful mammalia which formerly characterized the temperate zone in both hemispheres. This view is supported by the fact that it is among those groups only which are now exclusively tropical that all the more extraordinary developments of ornament and color are found. The local causes of color will also have acted best in regions where the climatal conditions remained constant, and where migration was unnecessary; while whatever direct effect may be produced by light or heat will necessarily have acted more powerfully within the tropics. And, lastly, all these causes have been in action over an actually greater area in tropical than in temperate zones, while estimated potentially, in proportion to its life-sustaining power, the lands which enjoy a practically tropical climate (extending as they do considerably beyond the geographical tropics) are very much larger than the temperate regions of the earth. Combining the effects of all these various causes we are quite able to understand the superiority of the tropical parts of the globe, not only in the abundance and variety of their forms of life, but also as regards the ornamental appendages and vivid coloration which these forms present.—*Macmillan's Magazine.*

THE POLICY OF AGGRANDIZEMENT.

By Professor GOLDWIN SMITH.

WHATEVER may be the result of the present campaign or of the present war, the Ottoman Empire is doomed. It was already doomed when England took up arms in its defense, and, in the supposed interest of her Eastern possessions, became its quasi-protectress, the sponsor for the engagements to its Christian subjects, which it has shamelessly violated, and the virtual surety for its now repudiated loans. The internal causes of its decay are more certain and deadly in their operation than the attacks of enemies from without, which, in fact, evoke and revive the only element of strength left in its composition—the native valor of the Ottoman. It is one of those military empires which have never become industrial, and which, the rush of conquest being over, and the conquerors having settled down as the dominant race, subsisting on the labor of the conquered, have been hurried by corruption and sensuality to the grave. It has never shown the slightest sign of civilization—political, intellectual, or commercial. If there

has been any trade in the empire, it has been among the subject races, especially those whose yoke has been loosened, not among the Turks. Political organization has never got beyond the coarse and barbarous form of military satrapies, whose rule is cruelty, and whose taxation is rapine. Even for military science the Turk has recourse to the foreigner. There being no security for the fruits of labor, production has failed, and the blight of barrenness has spread over some of the fairest regions of the earth. The provinces are heterogeneous, and under such a system of government no progress toward assimilation could be made. A fatalist religion has repressed effort, even the effort necessary to save life from the plague. The same religion, by its political intolerance, has precluded the fusion of the conqueror with the conquered, and kept hostile races facing each other in every part of the empire. The numbers of the dominant race have been always dwindling under the effects of vice and of the military conscription, which, as the slaves cannot be trusted with arms, falls on the masters alone. By the institution of the Janizaries, which constantly infused new blood into the military system, the period of conquest was artificially prolonged, and, in measuring the rapidity of Turkish decay, it should be borne in mind that less than two centuries ago the Turks were still conquerors. But, in the absence of external intervention, a century would probably have sufficed to complete the process of dissolution; the ill-cemented provinces of the empire would have fallen apart, and the satraps would have defied the bow-string, and set up for themselves. The revolt of Egypt was an example which, had things been left to their natural course, other pashas would have followed. Diplomacy intervened, and held together the crumbling mass. When the resources of fiscal robbery were exhausted, and the sheep of the rayah had been sheared in winter to pay his taxes, English coffers, opened by the confident assurances of English ministers, supplied money, of which the greater part was squandered in barbarous and bestial luxury, while the rest provided a standing army, which, by rendering internal insurrection against the tyranny hopeless, compelled the oppressed to stretch their hands for aid to a foreign liberator, and thus embroiled Europe; just as our ancestors under James II., who had a standing army, were compelled to call in a foreign deliverer; whereas, under Charles I., who had no standing army, they were able to redress their wrongs with their own hands. The present Turkish army may be victorious, but it will be the last, unless, by a miracle, confidence can be planted again in the bosoms of capitalists who have been swindled. Russia would, perhaps, have acted more wisely had she paused awhile, and allowed bankruptcy and repudiation to do their work. The question is one, not of sentiment or religion, but of political science; and it is a thing to be noted that a man so sagacious in a certain sphere as Palmerston, so adroit a manager of party, so clever a diplomatist, with all possible means of information at his command, should have persuaded himself that the Ottoman Empire was in course of rapid regeneration, only needing loans to complete the process, and should have induced his countrymen to lay down their money on the strength of that belief. It shows that in such questions the wisdom which styles itself practical, because it excludes general views and considerations, may lead to conclusions the reverse of wise. An ancient philosopher is said to have convinced his sneering countrymen of the utility of his science by a successful speculation in olives. We should be surprised to find that any one versed in the philosophy of history had been seduced into investing in Turkish bonds.

Fall the Ottoman Empire will, by corruption, if not by the sword; and its fall will apparently bring on a crisis in the destinies of England, who will be called on to decide whether, out of the wreck, she will take Egypt. If she does, she will be committed far more deeply than ever to the policy of aggrandizement; foreign dominion sustained by arms will assume a greatly-increased importance with her relatively to domestic objects; and the spirit of her people will undergo a corresponding change. Egypt obviously means Eastern Africa, probably, indeed almost certainly, Syria, from which the fatal canal is commanded almost as much as from Egypt; possibly Crete, or some other convenient island. But it means a good deal more than this. It means that England is to undertake to secure against any possible attack the whole of the overland route to India; for, of course, there is no use in holding the gate when the avenue to it is in other hands, and, if Port Saïd is the gate, the avenue to it is the Mediterranean. To India by the Cape we had, as it were, a private way, not leading by many hostile doors, nor obliging you to appear as dominant under the noses of rival nations; but the overland route runs by the coasts of a whole line of maritime powers, to which will be added Germany, if she ever acquires Trieste, and Russia (exasperated by our demonstrations of enmity),

if she ever acquires Constantinople; it is liable to attack from every port between Cherbourg and Port Saïd; its wardership will oblige us to flaunt the flag of our domination in the faces of all the dwellers on the Mediterranean. The present helplessness of France, no doubt, is our opportunity; but we are credibly assured that her jealousy will be at once aroused, and that her hostility awaits us in the end.

It is probable that in the present mood of the nation aggrandizement will carry the day. We say mood, and it does not seem that there has been any definite change of conviction such as new arguments produce since the time when more moderate views prevailed. But the nation is now flushed with wealth, and with the sense of power which wealth begets; it is infected with the military spirit which fills armed Europe; it has built a great fleet of iron-clads, and feels inclined to show its power. The aristocratic party is in the ascendant, and British aristocracy, as well as Russian despotism, is willing to divert the mind of the people from progress at home to aggrandizement abroad. The knowledge that the Government is favorable to them stimulates to activity all enterprising spirits, and at the decisive moment they throw into the scale, by enthusiastic and combined effort, a weight out of proportion to their mere numbers. In such a state of excitement are spirits of this sort at present, and so great has been the development of their ambition, that we read projects for making England mistress of all the water communications of the globe. What she would do with that magnificent possession we have not been informed. We need not to be informed what the other nations would do if they found all the water communications of the globe seized into the hands of one domineering power. There are politicians who, if they had their way, would make the battle of Dorking a reality in spite of Nature and of Fate.

Those who counsel England to seize on all the water communications of the globe seem to forget that, though still far the first of maritime powers, she is not, as she was at the close of the war with Napoleon, sole mistress of the seas. Other countries now have their navies, which, though singly not a match for hers, united must be a good deal more than a match, and which, moreover, would be free to strike with their full force, while she would have to disperse her force for the purpose of shielding unguarded dependencies in all parts of the world. Nor is it in this respect only that her position is changed. Her naval and military power depends partly upon her superiority in wealth; her superiority in wealth depends in great measure on her supremacy in manufactures, and this also has been greatly reduced by the development of manufactures in other countries since the Napoleonic wars. The commercial progress of other countries, especially of France, where the military spirit seems to be gradually giving way to the commercial, threatens British interests, even British interests in the East, more seriously than the approach of Russia to Herat.

That there are certain classes, administrative, military, and commercial, which have a special interest in a policy of aggrandizement, no one needs to be told; our ears ring with the vociferous demonstrations of the fact. What it seems particularly desirable to elicit, before the irrevocable step of occupying Egypt is taken, is the proof that foreign dominion is equally beneficial to the whole people. Beneficial, we mean, either in the way of material well-being or in the way of real moral and intellectual elevation. The mere pride of dominion we confess does not seem to us a sufficient object. Besides being radically antagonistic to the tendencies of modern civilization, its enjoyment is confined to the few who play the game; it is not shared by the many who pay and bleed, scarcely conscious all the time of the existence of an empire.

To all who have not entirely abandoned themselves to the prevailing impulse it must be clear that aggrandizement is a question to which there are two sides. That there are two sides to it in a moral point of view, we all imply as often as we denounce on moral grounds the territorial ambition of Russia. But let us put the question of morality aside. In truth, it does not present itself in a very serious form so far as the occupation of Egypt is concerned. The general concurrence of the powers, at all events, if it could be obtained, might relieve us from any misgivings on that score. The khedive is, to the mass of his unhappy subjects, not a national sovereign, but an alien oppressor, whose dominion has no foundation but brute force, and whose power is exercised without the slightest regard for the welfare of the people. Anybody who can is morally at liberty to overturn him and relieve the victims of his oppression. There can be no doubt that English government, however it might affect the destinies of the country in the end, would at present be an enormous change for the better. Nor is it easy to see who could cast a stone at us. Certainly not France, with Algeria

in her hands. Bismarck is wise enough, he is sufficiently conscious of the conditions of real strength, and sufficiently in accord with the spirit of his age himself, to abstain from distant acquisitions; but we need fear no moral protests on his part.

And so with regard to the Empire of India, which is the thing mainly in question all the time, and for the sake of which, principally, these further acquisitions are proposed. Once acquired it must be kept; mere anarchy would be the consequence of our withdrawal from it; and its acquisition commenced in a period which, though not so very remote, was yet anterior, if not to international morality, certainly to the inclusion within the pale of international morality of those who were not within the pale of Christendom. No government in Europe at that time would have shrunk from taking the territory of the pagans of Hindostan any more than they shrank from enslaving the pagans of Africa. France, since our censor, was at that time our competitor, and she herself took Algeria at a later day, when the light of a higher morality had at least dawned upon the civilized world.

With the question of morality, we repeat, we have here nothing to do; but to the question of expediency also it must be admitted that there are two sides. The decay of empires is the theme of history. They decay because they are sustained not by the moral forces which sustain national happiness, and the nature of which is to increase in strength, but by physical force, the nature of which is to decline, if not positively yet (what comes to the same thing) relatively to the forces around it. There is no reason why British virtue, energy, and industry, should not continue as they are, or increase with the lapse of time; and, therefore, there is no reason why the New-Zealander should ever moralize over the ruins of the British nation; but the man of the future, whoever he may be, is pretty sure one day to moralize over the ruins of the British Empire. We ourselves moralize over the ruined empire of Spain, and see clearly enough that the vast and scattered dependencies which were her pride, and which she imagined to be the sources of her strength, were really draining away her life-blood. We moralize over the effects of the error committed by Venice in leaving the true path, the path of commercial enterprise, to indulge a territorial ambition which led to the corruption of her government and, by the umbrage it gave to other powers, brought on her the League of Cambray. Yet we may be sure that every Spaniard and every Venetian, in the days of Spanish and Venetian empire, would have felt himself bound by loyalty and patriotism to uphold aggrandizement and to denounce counsels of moderation as a betrayal of the honor and greatness of the country.

Palmerston's *Civis Romanus* is one of many indications that the image of the Roman Empire still vaguely hovers before our minds. The Roman Empire belonged to an age before Humanity, to an age in which morality was in the germ, to an age in which force was the only law and the only principle of organization. Coming when it did, it formed a sort of matrix for modern civilization, and thus served a purpose which conquest can never serve again. By uniting all the nations round the Mediterranean under a common yoke it repressed war, the great primeval obstacle to the progress of humanity, and rendered possible the diffusion of ideas, besides breaking down generally the barriers of tribal isolation. An attempt to reproduce it, or anything like it, in these days would be an anachronism of the most flagrant kind. It sstability depended upon the absence of any rival power, when once the conquest of the Mediterranean nations had been accomplished; and, in this respect also, an imitation of it in a world divided among a number of great powers would be not so much unseasonable as insane.

It is worthy of remark, too, that the more advanced civilization even of Rome herself was less prone, if not actually opposed, to conquest. In the golden age of the empire, which commenced with the accession of Nerva, though there were frontier wars, and some extensions of territory, as a consequence of those wars, the spirit of improvement decidedly predominated over that of aggrandizement, and the Antonines, if they were alive now, would probably be "pseudo-philanthropists" and "patriots of every country but their own."

The idea of Roman conquest in the nineteenth century is equal in irrationality as well as cognate to that extreme theory of hero-worship which, totally ignoring historic progress, proposes to regenerate modern society by pounding it with the primeval sledge-hammer of Thor. The world changes, and the methods proposed by the worshipers of force for organizing what they imagine, in spite of their daily experience, to be an anarchy, would be the most brutal of all anarchies themselves.

At all events, there can be no harm in asking the advocates of a policy of aggrandizement clear-

ly to state the case with which we may fairly assume they are prepared. England will then advance her eagles not only with the assurance that some of her sons would be greatly gratified at present, but without misgiving as to the effect on the general welfare of her people for the future.

Does conquest bring strength to England? That is the most obvious question, and for the ordinary advocates of aggrandizement the most important. To the Roman it brought strength, because it brought him both tribute and military contingents; to the Spaniard it brought tribute, with which his armies were paid. But in the case of England modern sentiment interposes. England draws from her dependencies no tribute; large sums come from India, but they come into private hands. Sepoys were sent to Egypt at the time of the war with France, and Mr. Sidney Owen, in the preface to his "Selection from the Wellesley Dispatches," contends that, though they were not actually engaged, their presence produced an effect, and might be regarded as the symbol of a real addition to the military power of England. But rating this addition at the highest, and taking into consideration also any instance of the employment of negro regiments from the West Indies, will it be contended that the accession of force derived by England from her dependencies bears any proportion to the force expended by her in acquiring and defending them?

India must be debited not only with all that has been expended in her acquisition and defense, but with all that has been expended in securing access to her, and notably with a large portion of the cost of the Crimean War. But the expenditure, whether of money or of blood, is not all; the whole foreign policy of England quivers with alarm for India. We are being constantly drawn away from that which would otherwise be the manifest line of our interest by that besetting fear. Under its influence we have sullied our civilization by an alliance with the foul decrepitude of Turkey, and made an enemy of Russia, perhaps the only sincere friend we had in the world.

The Roman Empire, though colossal, was geographically united, and the provinces, as time went on, were more or less incorporated with the imperial state. The Russian Empire, though equally colossal, is also geographically united; it annexes conterminous regions, which are gradually incorporated, and will no doubt be thoroughly assimilated in the end. The Spanish Empire was scattered; its dependencies were incapable of incorporation, much more of assimilation, and the same is the case with ours. A line of communication with the East has to be maintained, to the length of which, and the forces threatening it at every point, attention has been already called.

In England the strength of England lies. Why this thought should be unwelcome, it seems difficult to say; at any rate, such is the fact.

In the days before free trade, monopoly of markets was a very intelligible and solid, though not a very laudable, appanage of empire. But free trade has thrown open the ports of the Indies, East and West, to all nations alike, and, if England still has the lion's share of the trade, it is not because she is the mistress, but because she is the great exporting nation. The commercial handling of the dependencies by planters, contractors, and others engaged in the internal production and trade, is, on the other hand, an advantage connected with political dominion. The only drawback from it is that English production in the dependencies may exclude British imports, as in the case of the cotton-manufactures of India, which are supplanting British goods in the Indian market.

It is said, and with truth, that empire trains soldiers and administrators. But are they not, for the most part, soldiers and administrators of a special kind? Algeria trained soldiers, and her training is said to have been one of the causes of the military disasters which befell France. Administrators generally end their official lives in the dependency, and the benefit of the Indian Civil Service is therefore reaped more by the individual Englishmen employed in it and their families than by the country, except in so far as the appointments may act as prizes in stimulating education. Even were it otherwise, bureaucracy, intensified by exclusiveness of race, and by severance from English society and opinion, would scarcely be a good school for the service of a free nation. The author of "The Abode of Snow" seems to be an acute observer, and he is certainly not indifferent to the glory of British dominion, or opposed to the extension of British influence. In a passage on official character in India, which, as its tenor is mixed, it may be fair to append in a note, he draws a strong, and what seems a probably just, distinction between the effect of India on superior minds, or those immediately under their influence, and its effect on the mind of the ordinary official. His general estimate may be somewhat adverse, and it may be fairly

met perhaps by an appeal to the net results of Indian administration. But he brings certain peculiarities, and the circumstances which produce them, distinctly under our view.[1]

We have renounced for the present purpose the consideration of morality, but we must be allowed to consider the influence of empire on the political character of the imperial country. Our free institutions with the character on which they rest, and the corruption of which they would not survive, are supposed, apart from sentiment, to be objects of paramount importance. The addition of an unconstitutional title to the constitutional titles of the British sovereign seems aptly to symbolize a tendency already perceptible, and which that measure was perhaps partly intended to assist. Dependencies, even under the mildest system, must be governed on principles wholly different from those of a constitutional polity, and, though superior minds may be able to keep the distinction between the two spheres always before them, and to don the despot without doffing the citizen, in ordinary minds the lines of separate allegiance will become more or less blurred and the indefeasible sanctity of freedom will be lost. The effect will be intensified by every rebellion which breaks out in a dependency, and, after exciting the passions of the imperial nation, is quenched in servile blood. It was for this reason that many people who were by no means admirers of the East India Company deprecated its abolition, and the political identification of India with England which necessarily ensued. The company being under the control of the British Government, the responsibility under the old system was the same, but the danger of political contagion was not so great.

Anglo-Indians, as a body, return rich; they must therefore have some political influence, and it would be interesting to know what their political tendencies are, and what sort of citizens India sends back to England. In former days, before the dependencies were controlled, both East Indian nabobs and West Indian planters avenged the oppressed native upon the dominant race by playing a leading part in the corruption of the English Parliament. It was on the East India Bill and with the support of the nabobs that George III. gained the victory over the constitution which established his ascendency, and enabled him to bring a train of calamities on the country.

But the reflex influence may go deeper still and affect not only those sentiments which lie at the root of political liberty, but those which lie at the root of all civilization. A conqueror necessarily persuades himself that his yoke is righteous, that submission to it is loyalty, that insurrection against it is the worst of treasons. He forgets that, as Pym said when Strafford pleaded that

[1] "Society everywhere in India labors under very great disadvantages, and varies very much according to the character of its ever-changing leaders. Sir Emerson Tennent has observed that it is, 'unhappily, the tendency of small sections of society to decompose when separated from the great vital mass, as pools stagnate and putrefy when cut off from the invigorating flow of the sea;' and he adds that the process is variable, so that a colonial society which is repulsive to-day may be attractive to-morrow, or a contrary change may take place with one or two departures or new arrivals. The same holds good in India; and though Indian society can boast of some superiority to colonial (a superiority which is amusingly asserted on board mail-steamers), it has very great defects of its own, and in certain circumstances degenerates into the intolerable. One tendency of life in India is to create an immense amount of conceit, and to make men assume airs of superiority, not because of any superiority of mind or character, or on account of great services rendered to the state, but simply because long residence in the country, or in some particular district of it, has given them high appointments, or the advantage as regards local knowledge. Then, though military society has many good points, 'discipline must be observed,' and it was in perfect good faith, and expressing his own opinion as well as that which he believed to be generally entertained, that an old Indian remarked to me, 'We don't think much of any one's opinions here until he is a lieutenant-colonel at least.' Of course, in all countries opinions are often measured by the position of the spokesman, but in Europe that is not so much the case as in India, and in our happier climes it is easy to shun the society of snobs, whether social or intellectual, without becoming a social pariah. This social tendency is not corrected, but developed rather than otherwise, by a close bureaucracy, such as the Indian Civil Service—and there is no other element in the community sufficiently strong to correct it—while it is almost justified by the extraordinary effect India has in rapidly producing intense conceit and insufferable presumption among Europeans of a low order of mind and character, whatever classes of the community they may belong to. Nothing struck me more in that country than the contrast between its elevating and even ennobling effects on those Europeans whose minds were above a certain level, and its exactly contrary effects on almost all those who were below that level. What, then, Indian society has specially to struggle against are two apparently opposite tendencies, a slavish respect for mere position, and for exceptional power and knowledge in particular directions; and, on the other hand, excessive individual conceit and presumption. But these evil tendencies (which, curiously enough, belong also to the Indian native character) are not opposed in any such way as to counteract each other. On the contrary, they are apt to foster and inflame each other, because the old Indian justly sees that he has opposed to him an immense deal of ignorant presumption, which ought to be severely repressed, while the democrat and the griffin instinctively feel that they are oppressed by an amount of tryrannical old-fogyism which would not be allowed to exist in any other country."—("Abode of Snow," by Andrew Wilson, p. 56.)

Ireland was a conquered country and you might do what you pleased in it: "If the king, by the right of a conqueror, gives laws to his people, the people must by the same reason be restored to the right of the conquered to recover their liberty if they can." The Scotch adore Wallace, but if they caught a Wallace in India they would blow him away from a gun. This inversion of morality by the conqueror in his own favor, with the effect which it produces on his character, is one of the ugliest features of conquest. The Sepoy was not a patriot, it is true, but he was an alien, and more than an alien, in race and in religion; he was a mercenary serving for nothing but his pay; to look for love and loyalty at his hands was looking for grapes on thistles; there could be no security for his fidelity but a vigilance which had been relaxed, and precautions which had been neglected. His caste—that is, his social and religious existence—had been threatened, as he imagined, by the greased cartridges. He had further been worked upon by the fiendish cunning of Nana Sahib, who had himself, it appears, been turned from a sycophant into a malignant enemy by unskillful handling. The frenzy into which the Sepoys burst was of the sort to which all barbarians are liable, and for which you must be prepared if you choose to take barbarians into your service. The wholesale slaughter of these wretched men, in cold blood, when they had laid down their arms, and in some cases when they had apparently been guilty of little more than being carried away like animals by a stampede, may have been a political necessity of conquest, but it will never be described by impartial history as an act of moral justice, and participation in it and in the hideous scenes of that period generally could hardly fail to affect the character of the Englishmen engaged. The work of Dr. Russell is well known. Lieutenant Majendie's "Up among the Pandies" is not so well known, but it is a vivid, simple, and apparently truthful photograph of scenes which that officer himself witnessed. We give a couple of extracts below,[1] and the reader will probably agree with Lieutenant Majendie that, let the guilt of the sufferers be what it would, the work of the executioners must have bred in them "hardness of heart" and "callous indifference to taking human life." Sup-

[1] "I have before adverted to the hardness of heart which in some cases was shown by our men, and to the careless and callous indifference with which they took away human life; and I will here relate one of several instances which came under my notice in illustration of this fact. After we had occupied the Iron Bridge for some days, and when we supposed that the houses in the neighborhood were quite clear of the enemy, we were astonished one evening by hearing a shot in one of the many buildings which we occupied, and, directly after, some of the soldiers rushing in dragged out a decrepit old man, severely wounded in the thigh. It seems that the sentry, having heard somebody moving about the house, had challenged, and, receiving no answer, fired, and hit the poor old wretch in question in the leg. He was brought out, and soon surrounded by a noisy, gaping crowd of soldiers, who clamored loudly for his immediate execution, expressing themselves in language more remarkable by its vigor than either its elegance or its humanity. 'Ave his nut off,' said one; 'Hang the brute,' cried another; 'Put him out of mess,' said a third; 'Give him a Cawnpore dinner' (six inches of steel), cried a fourth; but the burden of all their cries was the same, and they meant death. The only person in the group who appeared unmoved and indifferent to what was going on was he who certainly had every right to be the most interested. I mean the old man himself, whose stoicism one could not but admire. He must have read his fate a hundred times over in the angry gestures and looks of his captors, but never once did he open his lips to supplicate for mercy, or betray either agitation or emotion, giving one the idea of a man bored by the noise and the proceedings generally, but not otherwise affected. His was a case which hardly demanded a long or elaborate trial. He was a native—he could give no account of himself—he had been found prowling about our position at night; stealthily moving among houses, every one of which contained a quantity of gunpowder, and where, for aught we knew, and as was more than probable, mines may have existed, which a spark dropped from his hand would have ignited—or he was a spy, or—but what need of more? In this time of stern and summary justice (?) such evidence was more than ample; he was given over to two men, who received orders to 'destroy him' (the expression usually employed on these occasions, and implying in itself how dreadfully common such executions had become), and they led him away. This point being settled, the soldiers returned to their games of cards and their pipes, and seemed to feel no further interest in the matter, except when the two executioners returned, and one of their comrades carelessly asked, 'Well, Bill, what did yer do to him?' 'Oh,' said the man as he wiped the blood off an old tulwar, with an air of cool and horrible indifference which no words can convey—'oh, sliced his 'ed off,' resuming his rubber, and dropping the subject much as a man might who had drowned a litter of puppies" (page 222). This old man, it will be observed, was not a Sepoy, he was only a native, and not the slightest attempt appears to have been made to verify the suspicion as to a mine of gunpowder. In the next case the victim was a Sepoy, taken in a skirmish, in which a British officer of a Sikh regiment had fallen:

"Infuriated beyond measure by the death of their officer, the Sikhs (assisted, I regret to say, by some Englishmen) proceeded to take their revenge on this one wretched man. Seizing him by the two legs, *they attempted to tear him in two.* Failing in this, they dragged him along by the legs, stabbing him in the face with their bayonets as they went. I could see the poor wretch writhing as the blows fell upon him, and could hear his moans as his captors dug the sharp bayonets into his lacerated and trampled body, while his blood, trickling down, dyed the white sand over which he was being dragged. But the worst was yet to come: while still alive, though faint

pose these rebels had been natives of Algeria, and the executioners French Zouaves, should we not have been confirmed in the belief that Algeria was a doubtful gain to France?

The Sepoys were mutineers. But the people of Oude were not mutineers. They were fighting, most unwisely, no doubt, but not unnaturally, for their native dynasty. Their crime cannot be said to have been worse than that of the Scotch Jacobites, who are now objects of historic sympathy; yet they were included in the undiscriminating slaughter.

Lord Elgin was above the suspicion of pseudo-philanthropy, or of any weakness or illusion which could interfere with a rational pursuit of British interests. For that reason we shall make a free use of his testimony, as recorded in his "Letters and Diary." Visiting India, on his way to China, at the time of the mutiny, he came into contact with the spirit of sanguinary terrorism evoked among the dominant race; and the impression which it made upon him is not doubtful:

"*August* 21*st*.—It is a terrible business, however, this living among inferior races. I have seldom from man or woman since I came to the East heard a sentence which was reconcilable with the hypothesis that Christianity had ever come into the world. Detestation, contempt, ferocity, vengeance, whether Chinamen or Indians be the object. There are some three or four hundred servants in this house. When one first passes by their salaaming, one feels a little awkward. But the feeling soon wears off, and one moves among them with perfect indifference, treating them, not as dogs, because in that case one would whistle to them and pat them, but as machines with which one can have no communion or sympathy. Of course, those who can speak the language are somewhat more *en rapport* with the natives; but very slightly so I take it. When the passions of fear and hatred are ingrafted on this indifference, the result is frightful: an absolute callousness to the sufferings of the objects of those passions, which must be witnessed to be understood and believed.

and feeble from his many wounds, he was deliberately placed upon a small pile of dry sticks, which had been improvised for the purpose, and there held down, in spite of his dying struggles, which, becoming weaker and more feeble every moment, were, from their very faintness and futile desperation, cruel to behold. Once, during this frightful operation, the wretched victim, maddened by pain, managed to break away from his tormenters, and, already horribly burnt, fled a short distance, but he was immediately brought back and placed upon the fire, and there held till life was extinct." Englishmen were looking on all the time!

"*August* 22*d*.— ——— tells me that yesterday, at dinner, the fact that Government had removed some commissioners who, not content with hanging all the rebels they could lay their hands on, had been insulting them by destroying their caste, telling them that after death they should be cast to dogs to be devoured, etc., was mentioned. A reverend gentleman could not understand the conduct of Government; could not see that there was any impropriety in torturing men's souls; seemed to think that a good deal might be said for torturing their bodies as well. These are your teachers, O Israel! Imagine what the pupils become under such leading!" (page 199).

Subsequently, as governor-general, Lord Elgin had the opportunity of learning more of these events from sources which he deemed authentic:

"The feeling of the natives of India toward Canning was in some measure due to a similar cause. The clamor for blood and indiscriminate vengeance which raged around him, and the abuse poured upon him because he would not listen to it, imparted in their eyes to acts which carried justice to the very verge of severity the grace of clemency. I could give you plenty of proofs of this. . . . The following sentences occur in a letter written from Delhi during our recent panic by an officer: . . . 'The native force here is much too small to be a source of anxiety, and, unless they take the initiative, it is my opinion that there can be no important rising. The Mussulmans of Delhi are a contemptible race. Fanatics are very rare on this side of the Sutlej. The terrors of that period when every man who had two enemies was sure to swing are not forgotten. The people declare that the work of Nadir Shah was as nothing to it. His executions were completed in twelve hours. But, for months after the last fall of Delhi, no one was sure of his own life or that of the being dearest to him for an hour.'"

We might fancy ourselves reading an account of the reign of terror in Ireland after the rising in '98. That all this is not English, that it is utterly at variance with the general character of the English people, is certain; every candid critic of English society would say so; but no character is independent of circumstance, and if we choose to put ourselves into the circumstances of foreign conquerors, into the place of Nadir Shahs, the natural consequences will ensue. There is nothing to save us from them, any more than there was to save the Spanish conquerors of Mexico. From Egypt we shall infallibly be drawn on to Abyssinia; and in Abyssinia, if not in Egypt, there is likely to be just as bloody work as there has been in Hindostan.

Increased facilities of communication and rep-

resentation now bring scenes enacted in a distant dependency completely home to the minds of the people in the imperial country, so as closely to identify them with all that they do not repudiate and condemn. And when did the people of an imperial country heartily repudiate and effectually condemn acts necessary, or plausibly alleged to be necessary, to the maintenance of their own dominion?

In the Jamaica case we had a taste of the spirit which familiarity with slaughter in the case of the Indian rebels had evoked. All remember how Chief-Justice Cockburn charged in favor of outraged justice and humanity; how unavailing were his words; what homage was offered, and by what lips, to terrorism and murder; what sinister principles were propounded, and what ominous sentiments were expressed, not with reference to dependencies alone.

Less serious, but still worthy of notice, is the corrupting effect of the pageantry, the servility, the sultanism, of which dependencies are the licensed sphere. Through the newspaper accounts of the Prince of Wales's visit to India breathed something very like the spirit of a Byzantine court. Wise men laugh; but the crowd are impressed, and they do not say to themselves, "This is only for Hindostan or Egypt." If ever an attempt is made to revive anything like "a real throne" in this country (and the idea is perhaps not so remote from possibility as would be generally imagined), it will derive any chance of success it may have in some measure from the influence of the Indian Empire.

Therefore, before enthusiastic friends of England—and surely great enthusiasm may be predicated of those who can dwell with complacency on the idea of handing over not only the East but all Europe to the reactionary aristocracy of this country—before enthusiastic friends of England, we say, determine to give her Egypt, on the ground that she is the best representative of the principles of constitutional liberty, they ought to consider whether she is likely to continue the best representative of those principles when she has been charged with the functions of unconstitutional government in all parts of the globe. No political character could be stronger or more confirmed than that of the Roman, yet by empire it was radically changed.

The spirit of enterprise, no doubt, is displayed and fostered by conquest. Far be it from us to depreciate its value or to disparage the pride which its achievements excite in the nation. But it may be directed to more objects than one. Cook, Franklin, and Livingstone, showed enterprise as well as the conquerors of the Indian Empire.

It is the fashion to accuse the Americans of unlimited voracity, but they seem really to be about the only people that look at a thing before they swallow it. St. Domingo, from its natural wealth and capabilities, was a most tempting morsel, and it was almost forced down the throat of the nation by President Grant, who was then in an ambitious mood. But it was steadfastly rejected on the ground that, though commercially rich, it was politically unwholesome, and would import a bad element into the Legislature of the United States.

We have spoken, so far, of the interest of the conqueror, or the dominant race. But modern sentiment demands that the interest of the conquered, or the subject race, shall also be considered, and we may say with truth that no imperial country has ever acknowledged this obligation so fully as England.

To India, English rule has given peace, saving our own wars and mutinies; a regular and equitable though costly administration; greatly increased security for life and property; railroads; the abolition of dark and cruel superstitions, such as Suttee and Thuggee. On the other hand, there are consequences which attend even the most humane of conquests, and, when one nation undertakes to provide happiness for another by overruling the natural course of things, measures conceived in the most beneficial spirit are apt to work out in unexpected ways, and to lead to mixed results.

Conquest must always extinguish the military spirit of the conquered and their power of self-defense. Roman conquest did this systematically, and, when the legions withdrew, bands of undisciplined though hardy barbarians stalked unresisted through the helpless provinces of the empire. British conquest has done the same thing, though not on system, and populations which we found warlike are now sheep, and would be the prey of the first wolf that descended on them, if British protection were withdrawn. But conquest must also kill all native germs of political life and all power of political self-organization. It is, of course, difficult to say what Nature would have produced, had India been left politically to itself, or rather had it been acted on by European influence only as Japan has been, not in the way of foreign dominion. Regarded from the Indian point of view, Akbar was probably not less beneficent than a

viceroy, and whatever improvements he might effect would be more likely to adhere to the soil. In the case of Egypt, it is true, there would, so far as the mass of the natives are concerned, be little in the way of military, and nothing in the way of political, life to extinguish. We should only render impossible that which might otherwise be possible, the gradual growth, under an independent government, of an Egyptian nation.

To associate the conquered with the conqueror in the work of Indian government, and thus in time train India to self-rule, is a policy, the very conception of which attests the comparatively beneficent spirit of British conquest. But before it can be really carried into effect, not only must great political difficulties be overcome, but a bridge must be thrown over a social gulf, so wide as to be apparently impassable. Real participation in government implies political equality between the races, and political equality cannot exist between those who are socially far apart. The higher and more sympathetic minds may be able to surmount the prejudice of race, and to act with a Hindoo as cordially as with an Englishman. But this cannot be expected of the ordinary officials of the dominant nation, much less of the lower class of Europeans and the common soldier. We have heard Lord Elgin on the relations between the races. In another passage (p. 417), speaking of a murder committed by a European on a native, he says that, though not deliberate, it had a feature just as bad, and characteristic of homicides committed by Europeans on natives, inasmuch as it was done "in wanton recklessness, almost without provocation, under an impulse which would have been resisted if the life of the native had been estimated at the value of that of a dog." He goes on to mention another case, in which a native had been kicked to death for milking a goat which was alleged not to belong to him, and says that the local paper, instead of pitying the victim or his family, only complained of the hardship to which the homicide was subjected by having to go to Calcutta to answer for his conduct in hot weather. Assuredly, to make these two elements work together politically would be no easy matter. The gulf between the Hindoo and the European is no doubt partly caused by the strange primeval mystery of Hindoo nature. In the use of the Egyptian Fellah there would be no great obstacle of this kind; but the Fellah would probably be an object of still greater contempt than the Hindoo.

From war we have saved India. But what if in doing so we have unwittingly aggravated the danger of famine? What if, in the calm but enfeebling security created by our rule, a helpless and shiftless population has multiplied without any limit but that of bare subsistence, to be the prey of this periodical destroyer, or to be rescued only by Government aid on an enormous scale? We may well feel proud both of the humanity which accepts the burden, and of the administrative vigor with which it is borne. Yet this may be an instance of the tendency of interference with the course of Nature in other countries to work out in unexpected ways.

Since England has taken India into her own hands, her sense of responsibility has compelled her to introduce improvements, administrative and educational, on the pattern of the best European civilization. But can India afford this system? Can she afford it when she has to pay exile price for all her officials, and to give them all large pensions besides? She is gorgeous, but, in proportion to her population, poor. The Duke of Wellington is reported to have said of her: "She is a magnificent country, and it would be a shame to govern her ill; but it would be ruinous to govern her well." With an annual deficit always called extraordinary, yet regularly recurring, is it certain that the duke's saying will not prove true? Bankruptcy is a foe at least as much to be dreaded by the Anglo-Indian Government as the Russian legions which fancy sees descending from the clouds of the Himalayas.

From bankruptcy the Indian Government is in fact saved only by the revenue from the opium-traffic, which, as the present Secretary of State for India said in defending it, "involves inconveniences of principle, but is wrapped up in our finances." Inconveniences of principle the traffic does seem to involve, when we consider that it is not merely, like the liquor-traffic in this country, a trade licensed by Government, but a Government trade. The Chinese Government is semi-barbarous, but it is paternal; and there is no reason for doubting the sincerity of its desire to save the souls and bodies of its people from the ravages of this hellish drug. But we, impelled by financial exigency, constrain the Chinese to admit it and bombard Canton when they refuse. The excuses put forward—that Government limits the traffic by undertaking it, and that private villainy might commit the crime if Government did not—would hardly impose upon a child. Such, however, is the pillar of Indian finance and it can hardly be thought adamantine, unless morality and religion cease to be forces in the world.

The propagation of Christianity will hardly be alleged as the object of British conquest in India or anywhere else, especially as the governing class of the imperial nation is itself rapidly tending in a very different direction. Whatever else Christianity may be, it is not a religion of conquest. Its founders, and that later body of apostles who evangelized and civilized the northern tribes, presented themselves at all events as purely spiritual agencies, wholly unconnected with military power or with blowing rebels away from guns. A member of the Society for the Propagation of the Gospel would, perhaps, be shocked by the suggestion that whatever is best and most spiritual in the nature of a Hindoo would be likely to restrain him from abandoning the religion of his fathers to embrace the religion of the conqueror. If the number of converts made by the Church of England in India, backed as she is by power and wealth, were compared with the number made by Xavier, taking the latter at the lowest possible estimate, the result would be by no means flattering to political religion. Nor, if the testimony of the shrewdest observers may be trusted, are the converts of Xavier likely to have been less respectable or less sincere than those made by the Church of England.

The political dominion of India is a legacy from generations, the political aims, the commercial policy, the public morality, and the general conditions of which were different from ours. Whether, if it were offered to us now for the first time, we should do wisely in accepting it—whether it would not be better to secure free commercial access without political dominion—may be reasonably doubted. In fact, even the generations by which the empire was founded were drawn on for the most part, not only without design, but against their wishes, and were always trying to set a limit to the progress of conquest, though they could never succeed in doing so.[1] But, by a course of events which there is little use in discussing, as it cannot now be reversed, India has become ours; and nobody would now propose that we should either give it up or let it be taken from us. Independently of imperial pride, we are bound to maintain our hold on it by strong bonds both of duty and of interest. Our departure, after suppressing the native governments and destroying the organizing forces, would consign the country to a sanguinary anarchy, and place in jeopardy British property and investments, the aggregate value of which can hardly be less than four hundred millions. Still, of the two objects, India and England, the most spirited advocate of aggrandizement must allow that England is to be preferred, and therefore that there is a limit to the perils to be incurred, and the sacrifices to be made, for the sake of India. Some things have been mentioned which seem to show that this limit is not entirely beyond the horizon, and even that, unless Indian finances assume a more hopeful aspect, it may come very distinctly into view.

There are two ways of keeping our hold on India. One, and no doubt the more certain while it lasts, is to forego internal improvement, and to lavish the earnings of our people in the maintenance of armaments large enough to command the Mediterranean, at the same time occupying Egypt and every place else that may be necessary in order literally to annex India to England by an unbroken line of British territories, fortresses, and waters. The other way is to keep on good terms with the Mediterranean nations. Whatever depends on amity must be to some extent precarious. But there is no apparent reason why this amity should be broken. Our possession of India does not hurt or menace the Mediterranean nations in the slightest degree; it benefits them, so long as we keep the Indian ports open to their trade, and it need not give them any sort of umbrage. To do wanton mischief may be in their power, but there is no ground for presuming that they will be inclined to do it, especially as they would obviously hurt themselves. As to the potentate, whoever he may be, through whose territory the Suez Canal runs, he will surely be no more tempted to destroy or close it than a turnpike man is tempted to nail up his own gate.

That Russia meditates an invasion of British India is a belief which, if it were not shared by some persons of mark, we should be inclined to call a chimera. Mere proximity does not denote hostile designs; if it did, there would be no peace on earth. The natural barrier between the two empires is stronger than that between any other two conterminous countries in the world. If Russia, reckoning by mere miles, without regard to obstacles, is near to us, we are equally near to her; and if she has arrived at this position by continual additions of territory, we have done the same. Both empires have grown in the same manner, and one as naturally as the other, by extension in a sort of political vacuum, where nothing opposed them but the arms of barbarous or half-civilized powers. In each case, probably,

[1] *See* the preface to Mr. Sidney Owen's "Selection from Marquis Wellesley's Dispatches," and the dispatches themselves.

the growth has been to a great extent undesigned, and even involuntary, though we persist in ascribing to deliberate and far-reaching ambition on the part of Russia that which we know, on our own part, is to be ascribed to nothing of the kind. That either England or Russia, having reached the foot of the Himalayas by extending her empire over regions unoccupied by any civilized nation, will proceed to scale the Himalayas for the purpose of attacking another great European power, is as little to be presumed as it is to be presumed that the tide will scale the cliff because it has raced in over a sandy flat. The movements of Russia farther west are assignable to an obvious cause, and one totally unconnected with any imaginable designs on India. Every great and growing power is led by a natural impulse to make its way to an open sea. England would hardly submit to being corked up in the Dardanelles in order to gratify the jealous apprehensions of Russia, and she cannot expect that Russia will complacently submit to being corked up in order to gratify hers. Suppose Russia, like ourselves, obtains the full freedom of the Mediterranean. All diplomatists and Russophobists hold up their hands in horror at the thought. But what is the specific evil which would ensue? Why is Sebastopol, or, if it came to that, Constantinople, so much more likely to be dangerous than Brest? If Russia is provoked, she will very likely give us trouble in India; but why should she be provoked?

It is assumed that the Suez Canal would be available in time of war. This is a point on which, of course, we cannot presume to form an opinion; but it lies so near the root of the whole question that it is to be hoped a deliberate opinion will be formed. To occupy Egypt in defiance of the wrath and future hostility of France, to go to the expense of creating armaments powerful enough to command the eastern Mediterranean, and then to see the object for which all this had been done practically annihilated by a few shillings' worth of dynamite or the scuttling of an old ship, would be mortifying in the extreme.

Already our nervous anxiety about the canal has brought an avalanche of calamity on the world. To avoid this war with all its horrors, and the danger of further conflagration which it involves, it was necessary that from the outset separate interests should be suppressed, and that the crisis should be treated as a European one, to be dealt with by the common councils of Europe. But hardly had it arrived when England avowed her intention of separately securing her own interests, and pounced upon the Suez Canal. This was the signal that a wreck had commenced, and that everybody must look out for himself. Everybody did look out for himself; everybody made his own game. Cordial coöperation thenceforth was impossible, and the inevitable result was this war—a war which puts back civilization. Lord Derby has said that of British interests the greatest is peace, and what Lord Derby says is always wise. If we ask why Lord Derby did not make a sincere and resolute effort to preserve the greatest of British interests by enforcing in common with Russia and the other powers the reforms to which Turkey was pledged, and which, if vigorously pressed, she would most certainly have conceded, the answer will partly be that this obvious line of policy was crossed by the alarm about the Suez Canal and the interests of England in the East.

Egypt no doubt differs greatly in some respects from India. But in Egypt, as in India, you would have a dominant and a subject race. You would have a foreign government ruling, on arbitrary principles, over people divided from the officials by a wide social gulf. The reflex action on the character of the imperial country would probably be much the same.

In the course of empire, one act of aggrandizement leads to another. The conquest of a small territory round the British factories in India has led to the conquest of the whole country. This, again, leads to the occupation of Egypt. India being in the hands of England, no one will deny that the occupation of Egypt, in case of a break-up of the Turkish Empire, presents itself as a natural question for consideration. But the advocates of the measure must allow it to be fairly discussed, and not think to settle it by impugning the patriotism of their opponents, though, as we have already admitted, the nation is just now in a mood in which such appeals are likely to tell. If the party of moderation is inferior to the party of aggrandizement in anything, it is not in love of the country, but in power of discerning her true interests. It does not seem to itself to be advocating a policy of weakness. It holds that, as we said before, the strength of England is in herself, and that she derives more real strength from one of her own counties than she does from all her foreign dependencies put together. It holds, in fact, that acquisition of territory which is not self-defending is extension, not of strength, but of weakness; and in proof of the fact it may cite, among other things, the perpetual complaints of its opponents that the em-

pire is unfortified, and their unheeded cries for further expenditure in defenses.[1] It avows that its main objects of interest are not external but internal, and that it is less solicitous about remote acquisitions, and those posts in Asia the names of which are dear and familiar to the pundits of Russophobia, than about the many millions of Englishmen who at present share only to a very miserable extent the advantages, moral, intellectual, or material, of English civilization. It does not admit that this is "parochialism," unless England is a parish. It desires, at all events, to see the proof that aggrandizement is good for the whole English people. As to the question of courage or cowardice, which is sometimes raised in the fervor of debate, statesmen and journalists, however bellicose, do not go to the front; and the only way in which they can show courage of any kind is by manfully expressing what seem to them true opinions, though they may happen to be unpopular at the time.

To make a perfectly clean breast, we will confess that there are some people who believe that the consecration of filibustering nationality is rather out of date; that the day of humanity has dawned, and that to resent its arrival is about as rational as to resent the arrival of autumn or anything else that the course of Nature brings.

It is the more desirable that at this crisis, on which the policy of the future may depend, there should be a full discussion of the subject in the press (which is now, more truly than Parliament, the great council of the nation), and that the mind of England should be deliberately made up, because otherwise her hand may be forced by agencies which the respectable advocates of aggrandizement would disown, though they can hardly help warming them into life by encouraging the general tendency and decrying the principles which restrain it. For a description of these agencies we will once more have recourse to Lord Elgin, who encountered them in China, where they have more than once been successful in drawing England into a use of her power which, it is to be hoped, no party among us would have deliberately approved:

"I never felt so ashamed of myself in my life, and Elliot remarked that the trip seemed to have made me sad. There we were, accumulating the means of destruction under the very eyes, and within the reach, of a population of about 1,000,000 people, against whom these means of destruction were to be employed! 'Yes,' I said to Elliot, 'I am sad, because when I look at that town, I feel that I am earning for myself a place in the Litany immediately after "plague, pestilence, and famine." I believe, however, that, as far as I am concerned, it was impossible for me to do otherwise than as I have done. I could not have abandoned the demand to enter the city after what happened last winter, without compromising our position in China altogether, and opening the way to calamities even greater than those now before us. I made my demands on Yeh as moderate as I could, so as to give him a chance of accepting; although, if he had accepted, I knew that I should have brought on my head the imprecations both of the navy and army and of the civilians, the time being given by the missionaries and the women. And now Yeh having refused, I shall do whatever I can possibly do to secure the adoption of plans of attack, etc., which will lead to the least destruction of life and property.' . . . The weather is charming; the thermometer about 60° in the shade in the morning; the sun powerful, and the atmosphere beautifully clear. When we steamed up to Canton, and saw the rich alluvial banks covered with the luxuriant evidences of unrivaled industry and natural fertility combined; beyond them, barren uplands, sprinkled with a soil of reddish tint, which gave them the appearance of heather slopes in the Highlands; and beyond these again, the white-cloud mountain-range, standing out bold and blue in the clear sunshine, I thought bitterly of those who, for the most selfish objects, are trampling under foot this ancient civilization."—("Letters and Journals," page 212.)

"I am now off from Canton, never, I hope, to see it again. Two months I have been there, engaged in this painful service, checking, as I have been best able to do, the disposition to maltreat this unfortunate people. . . . On the whole I think I have been successful. There never was a Chinese town which suffered so little by the occupation of a hostile force; and, considering the difficulties which our alliance with the French (though I have had all support from Gros, in so far as he can give it) has occasioned, it is a very signal success. The good people at Hong-Kong, etc., do not know whether to be incredulous or disgusted at this policy" (page 224).

"The settlement here is against treaty. It consists mainly of agents of the two great opium houses, Dent and Jardine, with their hangers-on. This, with a considerable business in the coolie trade—which consists in kidnapping wretched coolies, putting them on board ships where all the horrors of the slave-trade are reproduced, and sending them on specious promises to such places as Cuba—is the chief business of the 'foreign' merchants at Swatow" (page 226).

"Besides, I own that I have a conscientious

[1] The Canadian Government was asked the other day, by an eminent organ of aggrandizement, to quadruple its military expenditure, and this in the face of a falling revenue. You might literally as well ask the Canadian Government for their heads.

feeling on the subject. I am sure that in our relations with these Chinese we have acted scandalously, and I would not have been a party to the measures of violence which have been taken, if I had not believed that I could work out of them some good for them. Could I leave this, the really noblest part of my task, to be worked out by others? Any one could have obtained the Treaty of Tientsin. What was really meritorious was, that it should have been obtained at so small a cost of human suffering. But this is also what discredits it in the eyes of *many*, of *almost all*, here. If we had carried on war for some years, if we had carried misery and desolation all over the empire, it would have been thought quite natural that the emperor should have been reduced to accept the terms imposed upon him at Tientsin. But to do all this by means of a demonstration at Tientsin! The announcement was received with a yell of derision by connoisseurs and baffled speculators in tea" (page 280).

"Have you read Russell's book on the Indian mutiny? I have done so, and I recommend it to you. It has made me very sad; but it only confirms what I believed before respecting the scandalous treatment which the natives received at our hands in India. I am glad that he has had courage to speak out as he does on this point. Can I do anything to prevent England from calling down on herself God's curse for brutalities committed on another feeble Oriental race? Or are all my exertions to result only in the extension of the area over which Englishmen are to exhibit how hollow and superficial are both their civilization and their Christianity? The tone of the two or three men connected with mercantile houses in China, whom I find on board, is all for blood and massacre on a great scale. I hope they will be disappointed; but it is not a cheerful or hopeful prospect, look at it from what side one may" (page 325).

Lord Elgin, we repeat, was neither a pseudo-philanthropist nor a patriot of every country but his own; he was wanting neither in British feeling nor in courage; and the records of his experience deserve attention, as well as the snortings of the war-horses on the Stock Exchange and in Pall Mall.

—*Fortnightly Review.*

THE SKEPTICISM OF BELIEVERS.

By LESLIE STEPHEN.

NOT long ago an interesting question was discussed by a respectable and presumably competent meeting. Why, it was asked, does not the spiritual warfare against the unbeliever meet with greater success? A "materialistic atheism," as a high authority assured us, is "in the air;" and the malign contagion spreads in spite of Bampton lecturers, Christian Evidence Societies, and other apologetic machinery. At all which it is hard not to exclaim, *Sancta simplicitas!* Can you really not guess this very open secret? Men die of many diseases; creeds of one—the disease of being found out. Do you ever remember that David Hume died a century ago, and that the matter which absorbs the intellects of the most zealous part of the clergy at the present day is the "eastward position?" When such a spectacle as the Folkestone case is presented to gods and men, what wonder that unbelief spreads? If a more articulate reply were requested, one might perhaps say that the old belief is perishing chiefly for two reasons: first, because it has become a sham belief; secondly, because it is a negative belief. No man can make converts who does not believe what he says; nor will he, as a general rule, make them rapidly, when his creed consists chiefly in denying the strongest and most fruitful convictions of his neighbors. I shall not here inquire into the first of these explanations; but it may be worth while briefly to defend the other, which, indeed, is, at first sight, in greater need of defense.

It sounds paradoxical to declare that the orthodox belief is essentially skeptical. The infidel is popularly identified with the Mephistopheles, whose essence it is to deny. He denies, it is said, a hereafter and a divine element in the present. That denial implies the abandonment of the most cheering hopes and highest aspirations of mankind. To bring the charge of skepticism against those who are fighting against materialism and atheism is at best to indulge in a frivolous *tu quoque*. A parallel phrase, however, is common on the lips of the orthodox. It is a commonplace to taunt skeptics with credulity, nor is the taunt without foundation. So long as men of science continue to dabble in the filth of "spiritualism" it will have a meaning. A confessor is, after all, better than a medium; and I

would rather revere the miracles of Lourdes than grovel before the trickery of a Yankee conjurer. Moreover, to leave a disgusting subject, the remark is really significant. To speak brutally (as is sometimes pleasant and healthy), one might say that faith is often used to signify belief in my nonsense; credulity, belief in somebody else's nonsense. Now, it is unfortunately true that the rejection of one kind of nonsense is not a sufficient security for the rejection of all nonsense; it follows that skepticism and credulity may mean the very same thing: the acceptance, that is, of a doctrine which is skeptical so far as it contradicts my opinion, and credulous so far as it falls in with yours. It is worth while, however, to look at the matter a little more closely.

Skepticism, in the most absolute sense of the word—a rejection of belief as belief—is, if not a rigidly unthinkable, at least a practically impossible state of mind. Metaphysicians may play with such a doctrine; as they may urge that it is a legitimate consequence of their opponents' theories. Nobody doubts, however, that if they succeed in fastening that imputation upon any system, they have established a legitimate *reductio ad absurdum*. As a matter of fact, absolute skepticism does not exist. It is rather impossible than erroneous. There is a vast body of truth in regard to which the thinkers generally known as skeptical are fully as confident as their opponents. Mr. Mill, for example, was just as certain as Descartes in any given case that two and two made four, whatever doubts he may have suggested as to the ultimate ground of belief. Indeed, the same thinkers who are charged with skepticism are equally charged with an excessive belief in the invariability and certainty of the so-called "laws of Nature." They are reviled equally for being skeptical and for being dogmatic, for having too few convictions and for having too many. No man, of any school, really denies the possibility of attaining certainty in regard to all such propositions as admit of verification by experience. The real problem discussed is not — ought we to believe, but *why* ought we to believe that two and two make four, or that Rome exists, or that the planets obey the laws of gravitation? The believer in necessary truths asserts by the very form of his argument that his adversaries do in fact believe, and cannot help believing, the truths which he alleges to be necessary, though they may deny the propriety of that epithet. The thorough-going empiricist may suggest that in some sense the most evident truths would cease to be valid under some other conditions; but he does not deny them to be valid within the whole sphere of possible experience. By attacking the supposed distinction between different classes of belief, he really elevates the claims of empirical knowledge as much as he depresses that of *a priori* knowledge. We can no more alter the absolute intensity of belief in general than we can change our centre of gravity without some external point of support. One set of thinkers holds that we must pierce to the absolute in order to provide foundation for the whole edifice of belief. Their antagonists declare that such a foundation can never be discovered, but they add that it is not needed. As the universe no longer requires the proverbial world-sustaining tortoise, so the world of belief requires no reference to anything outside of experience.

The point is obscured by the habit of speaking of "belief" absolutely, without describing its particular contents, and of proceeding to describe it as in some sense a creditable, whereas unbelief is taken to be a discreditable, state of mind. The inaccuracy of the assumption follows from the obvious simple consideration that belief *is* unbelief. It is the very same thing seen from the other side. It is a mere question of accidental convenience whether a belief shall be expressed positively or negatively; whether I shall say, man is mortal, or man is not immortal. The believer at Rome is, by virtue of his belief, the skeptic at Mecca, and inversely. The believer in the Ptolemaic system has neither more nor fewer beliefs than the believer in the Copernican system; he has simply a different set of beliefs. To say, therefore, that belief *qua* belief is better or worse than unbelief involves a contradiction in terms. In the very act of asserting we deny; and it is a transparent fallacy, though an example of a very common class of fallacy, to give an absolute and universal character to a proposition which by its very nature can be only true in a particular relation. Belief and unbelief being identical in nature, either is good just so far as it is reasonable or logical; that is to say, so far as it conforms to the rules which secure a conformity between the world of thought and the world of fact. In spite of all the slipshod rhetoric about faith and reason, no other test is admissible or can even be put into coherent and articulate shape. If we still speak of skepticism as a mental vice, we must mean a reluctance, not to believe in general, but to believe what is reasonable; and in this sense the most skeptical man is

he who prefers the least weight of evidence to the greatest.

The popular line of distinction corresponds, indeed, to a very important divergence of thought, though not, in any strict use of language, to a distinction between belief and unbelief. That man is generally called a believer (and I shall use the word in that sense) who asserts, while the unbeliever denies, the possibility of rising to a transcendental world. The sphere of the believer's creed is therefore wider, it may be said, than that of the unbeliever. His world transcends or envelops that of his opponent, and he accepts a whole category of propositions in regard to which the unbeliever maintains the neutral attitude of absolute doubt. But this statement is at least inadequate. As a so-called disbelief is simply a belief differently stated, so a belief about the other world, so far as it can be called a belief at all, and certainly so far as it can have any influence, is of necessity a belief about this. Beliefs belonging to the transcendental sphere may be of the highest importance so far as they modify or so far as they give strength and coherence to beliefs about the ordinary world of experience. They give the adjective which modifies the meaning of the substantive. But, except as influencing our conduct, belief about heaven and hell would be of no more importance than a belief about the inhabitants of Sirius, and, so far as it influences our conduct, it is capable of translation into terms of ordinary experience. That other world upon which the believer gazes is either a superfluity or is essentially a new light cast upon this world. You may, for various reasons, talk about the light abstractedly from the thing lighted, but it might as well be darkness except as revealing some new aspect of concrete objects. The dogmas of the believer may extend farther or pierce deeper than those of the unbeliever, but their vitality is entirely within the region to which both have access. The creed about the beyond, when not a set of words, is but another mode of stating a belief about the present. The vulgar epicurean infers from the shortness of life that eating and drinking are the only pleasures worth enjoyment. The ascetic infers from the same fact that sensual pleasures are worthless. Each has as definite a creed as his rival, and as capable of expression in peremptory terms. Whether we express doubts as to the reality of future or of present pleasures, or beliefs as to the reality of their evils, we may equally have a dogmatic creed capable of serving for a rule of conduct. Every genuine belief, in short, which refers to the transcendental world, carries with it a reference to this, which may be accepted or denied by those who would in terms most narrow the sphere of belief.

This illustration, however, suggests the really important distinction. Some creeds do in fact supply motives for consistent and vigorous action, while others produce a paralysis of the will. This is not because one creed expresses an absolutely greater quantity of belief—if one may say so—than its rivals. Creeds which once prompted to the most energetic action have become simply obstructive, like Mohammedanism; and some of the most intense beliefs in the world, as some forms of fatalism, are more depressing than any doubts. But, as a general rule, creeds must lose their stimulating power when they tend to produce doubt in presence of the great emergencies of life. If one creed gives a definite precept when its opposite leaves the mind undecided between conflicting precepts, the first will be best adapted for energetic persons. Such a creed, moreover, can be most simply expressed in terms of affirmation when its opposite most easily takes the negative form. It is more natural, that is, to give the positive form to the rule which prescribes one out of a dozen courses of action than to the rule which asserts them to be all equally promising. And, in this sense, the positive is more likely to be stimulating than the negative form, or, if we choose so to speak, belief than skepticism. We might infer that, as a creed ceases to possess its old power, the negations which have always been latent in its affirmations will tend to assume greater prominence. They must, in fact, become more distinctly operative. The creed is depressing when it restrains more frequently than it impels. But the tendency is obscured by the habit of using the old forms; and the creed which is most skeptical in this sense—most incapable, that is, of suggesting powerful motives and efficient restraints—may still express itself in the positive language. We must decide upon its real tendency, not by simply examining the form of its utterance, nor by asking how many beliefs it expresses, but by inquiring, as well as we can, which side of the creed is most important in relation to the conditions of the sense. Such an inquiry will be facilitated by bringing into distinct light those implicit denials which are overlooked in the ordinary statements. If we thus ask what it is that the Christian faith, as now existing, actually denies, we may possibly find some explanation of its failure to meet the unbeliever.

One or two familiar arguments from the evidence-writers may give a clew to the inquiry. A man believes in the immaculate conception. He denies, then, that a certain event took place in accordance with laws exemplified in all similar cases. He impugns in this instance the validity of that inductive process upon which he counts at every step in daily life. He is a scientific skeptic in the strictest sense, for he is throwing doubt upon the trustworthiness of one of the primary ratiocinative processes. The same is true, whenever an event, admitted by all parties to have occurred, is ascribed by one party to supernatural interference. An amiable apologist expressed his surprise the other day that men of science should take into account such trifles as the existence of flint implements, and refuse to take into account the existence of the Bible and of Christianity. Surely he never heard of the men of science who denied the existence of the Bible and of Christianity. Which man really declines "to take a fact into account"—the man who declares it to be altogether exceptional and supernatural, or the man who regards it as a result of the normal operation of recognized forces? Which implies the greatest "skepticism"—the assertion that somebody wrote the book of Genesis by faculties similar to those which enabled another to write Homer, or the assertion that it is utterly impossible that anybody would have written down the legends of the Garden of Eden and the Ark, without the direct assistance of God Almighty? If it is skeptical to deny one agency, it is equally skeptical to deny the other. What is given to Jehovah is taken from Moses.

In the more common case of miracles, the fact is denied as well as the explanation. The "skeptic" refuses to believe the myth of the Magi, because the story involves impossibilities and rests upon no evidence. Somebody—we know not who—wrote—we know not when—on some authority—we know not what—a story which involves a belief in doctrines shown to be false, and showed, by ignoring all difficulties, his entire innocence of critical principles. To disbelieve the story is called skeptical. Why? The disbelief implies the assumption that evidence is fallible, and that, in particular, unfounded stories may obtain currency in a sect when they tend to honor its founder. Does any human being deny those assumptions? Nay, does not every one who asserts the truth of this particular legend implicitly assert them in regard to every other creed but his own? The so-called skeptic does not differ from the believer in regard to any general principles of evidence. He merely asserts the evidence to be non-existent in this particular case, and refuses to believe without evidence. The phenomenon, admitted on all hands, is the existence of a certain narrative. One thinker classes it with authentic history; the other classes it with a well-known variety of popular legend. Neither denies the existence of much authentic history or of much groundless legend. If we accept as the measure of the "skepticism" involved the weight of evidence resisted, he is most skeptical who is most illogical; and it is as skeptical in one man to deny the capacity of the human imagination as in the other to deny the intervention of a supernatural agent.

It is of course open to the believer to show that the rejection of this particular story involves the rejection of a whole narrative resting upon sufficient evidence. The argument is of the less importance, because miracles in this sense are now seldom alleged as evidence. People have become sensitive to the inconsistency involved in basing a theory of the universe upon the alleged exceptions to the general order. But another argument, now put forward with more confidence, illustrates in a more important case the skepticism of believers. The character of Christ, we are told, is absolutely perfect. The moral code which he preached is equally perfect. The spiritual force which he revealed is the only one capable of swaying human nature. The appearance of such a teacher, the promulgation of such a code, and the revelation of such truths, constitute an event in history so unique that it can be explained by nothing short of a divine intervention. Nay, the discontinuity implied is of so vast an order that nothing can explain the facts short of the stupendous miracle of the incarnation of the ruler of the universe. If the unbeliever grants substantially the facts alleged, he has still to discuss the real problem. Grant Christ to be perfect—is the difference between him and the best of his race such that it must correspond to the difference between man and infinity? Grant his teaching to be of flawless purity and unrivaled power—are we to infer that nothing but the inconceivable catastrophe suggested can explain the knowledge and the power displayed by the founder of Christianity?

The question is, briefly, whether the facts thus assumed are exceptional or miraculous. Every fact that ever did or will exist is in some sense exceptional; that is to say, it exemplifies the working of certain invariable laws under conditions not elsewhere precisely realized. Given

the necessary conditions, we must always obtain extreme cases, which do not contradict, but confirm, the general law. One comet has the most eccentric orbit; one man the most gigantic stature; one artist the loftiest and finest genius. But the comet obeys the laws of gravitation as rigorously as the most domestic planet; the giant is a physiological curiosity, but does not imply any exception to physiological rules; and we admit that the genius of a Phidias implies, not the incarnation of a god, but the occurrence of a special set of social and other conditions. A giant one thousand feet in height, made of ordinary flesh and blood, would be an impossibility, or, in other words, his existence would be miraculous; but giants of eight or nine feet have existed, and may therefore exist, without implying any breach of natural law. The question of their possibility must be decided by our knowledge, derived by ordinary scientific processes, of the nature of flesh and blood and the limits of the variability of the species. Similarly, to prove the divinity of Christ by such reasoning, we must prove the superiority of Christ and of Christian morality to be not simply unmistakable, but to be so great that it is beyond the reach of the most exceptional nature placed under the most exceptional circumstances; and, further, if the divinity of the Teacher is to be established, this superiority must be so great as to be fairly called infinite. Briefly, then, the believer denies, while the unbeliever asserts, that under appropriate conditions human nature may produce a Christ without any breach of the ordinary laws, though it may be that we are in presence of an extreme case of those laws. The test by which the validity of either conclusion must be established is the correspondence of the rival theories with our independent knowledge of mankind. Hence it is easy to note the assumptions involved. The unbeliever, basing his judgment upon experience, has formed his estimate of human nature from the facts before him. He sees that the race has produced many great religious teachers, among whom he may (or may not) reckon Christ to be the foremost. He believes that his creed can produce a Christ, because it has produced a Christ. It might conceivably appear that the classification of Christ as a man was erroneous, and that there was an insuperable gulf between him and all who externally resembled him. The unbeliever denies the existence of this discrepancy, and holds that, though Christ may exceed the ordinary stature even more distinctly than Phidias exceeded the average sculptor or Shakespeare the average poet, the excess does not exceed the recognized limits of variability of the race, as inferred from observation. Genius exists, and Christ was (on this hypothesis) the greatest of moral geniuses. The procedure of the believer is different. He has assumed, more or less explicitly, that all virtue is supernatural; that Christianity and Judaism represent the true light which comes from God, of which a few scattered beams alone have fallen upon other creeds. Human nature, then, is merely the residuum left, when all good impulses are assumed to come from without. Our nature, in this pure phrase, is corrupt; our heart is deceitful above all things, and desperately wicked. From ourselves comes nothing but lust, hatred, and the love of darkness. It is only consistent to infer, when this has been assumed, that human nature cannot produce a Christ. But, when this has been assumed, the question has been begged. Instead of framing our theory from instances actually observed, including Christ, it has been framed by summarily excluding all great teachers as either the direct or indirect channels of a supernatural impulse. Christ must be God, because all men are devils.

The skepticism involved in such "belief" is obvious. It implies a denial of the natural goodness of man—a refusal to believe that purity, love, and heroism, of a certain order can spring spontaneously in the soil of human nature. Where such growths are to be found, they must be taken to have been transplanted from a supernatural paradise. They are the sporadic plants which have strayed beyond the guarded walls of Eden, and can only struggle against the foul, indigenous products by the constant care of the Divine Gardener. Every living theology is saturated with such skepticism; for our conviction of the necessity of supernatural aid is measured by our sense of human impotence. The doctrine of the corruption of human nature is the central doctrine of all vigorous theological creeds. The belief in God is, in this sense, simply the opposite pole of disbelief in man. They are reciprocal dogmas, allied as the light and the shadow. The doctrines of redemption and the atonement are realized in proportion as this need is felt, and die away or are rationalized into sheer no-meaning wherever it becomes faint. And therefore the belief in the supernatural character of a religion is but the other side of a skepticism as to human virtue, when not reposing upon a supernatural basis, enlightened by supernatural revelation, and stimulated by hopes and fears of a supernatural world.

This brings us in sight of that ground of hostility to "unbelief" which has the greatest weight

with a very large class of believers. A legitimate objection to part with the ancient creed may rest upon philosophical, or moral, or æsthetic grounds. Ultimately, it may be said, the questions are all one. The true, the good, and the beautiful are, we may admit, in some sense identical. The one final question is, therefore, "What is the truth?" The æsthetic objection to change becomes contemptible when it admits as a possibility that a belief known to be false may still be beautiful. The moral objection becomes at best a respectable prejudice when it implies a reluctance to press philosophical doubts to their ultimate issue. But, while accepting this most emphatically, it may be worth while to point out what are the assumptions involved in the moral objection without examining their ultimate validity. It is asserted, in a great variety of forms, that the sense of duty is based upon some kind of belief in theology. Whether embodied in the blunt assertion that men would be murderers, liars, and adulterers, but for hell-fire, or diluted into the more abstract theory that we cannot preserve our loftiest ethical conceptions without preserving our belief in the divine order of the universe, this doctrine is not merely proclaimed by mere bullies of the pulpit, but is expounded by serious thinkers worthy of all respect, and therefore represents a force with which we clearly have to reckon. Let us endeavor to draw out in articulate shape the positions tacitly assumed by its defenders.

Perhaps the most important task for philosophers at the present day is that of placing morality upon a scientific basis. We cannot expect that any moral theory will yet deserve the name of a science. But we may hope to prepare the way. We may confirm principles already established by empirical methods, show in what direction and in what sense they are capable of modification, and save them from a dangerous association with the decaying and inconsistent theories of theological metaphysics. The first condition of success is the rejection of the main contention of the theologian. We must get rid of the whole scheme of thought which asserts, more or less explicitly, the necessity of a supernatural basis for moral beliefs. If morality is to be scientific in method, though not a completely coördinated body of scientific truths, we must find our data within Nature, that is to say, within the sphere accessible to the ordinary methods of investigation. Morality, that is, like political or sanitary sciences, must be placed upon a sound inductive basis, if we admit, as most serious thinkers virtually admit, that no other basis is trustworthy.

The constructive method follows from this primary assumption. Morality must rest upon the truths which, if fully ascertained, would form the science of "sociology." We can, it is assumed, determine with sufficient accuracy what are the laws which regulate the development of the social organism, and what are the conditions imposed upon it by its environment. We can infer what are the individual instincts which contribute to its growth and stability; and what, consequently, are the laws, a recognition and acceptance of which would be favorable to its healthy development. Laying them down we should virtually construct the moral code. Further, we should investigate the process by which the race has gradually felt out certain rules essential to its welfare. We should find that they have neither been imposed from without nor deduced from abstract speculation. The race has discovered that the practice of murder is injurious to its welfare, as it has discovered that intoxication is prejudicial to health—by trying the experiment on a large scale. The so-called intuitions will of course be deprived of their supernatural character, and regarded simply as assumptions verified by experience, and now capable of independent proof, though not originally discovered by abstract reasoning. They will have the weight due to the experience of ages, and in their main outlines may be taken to be just as much beyond the reach of possible refutation as any of the primary data of observation. They are as certain as any of those simple rules which are confirmed by daily and hourly experience—as certain as the laws that men are mortal, that fire burns, and water drowns; and such certainty, if it does not satisfy metaphysicians, is enough to regulate practice. We should infer, again, that the development of society is conditioned by, and tends in its turn to stimulate, the growth of those higher instincts which are unintelligible in regard to the isolated unit, but essential elements of the great binding forces of society. We should see how their growth is interwoven with the growth of the intellectual and emotional faculties, and determine the conditions favorable to their strength, and calculated to make them contribute to individual as well as to social welfare. We should then be in a position to examine the nature of the most efficient sanctions of morality. How is an observance of the rules essential to the welfare of the race to be enforced upon its individual members? The unbeliever has to ad-

mit that antisocial instincts exist, and will exist. He is not concerned with the difficulty, which has perplexed theologians since the days of Job, as to the unequal distribution of rewards and penalties in this world, nor with the solution reached by postulating a complementary world in which all the wrongs will be redressed. He may hope that the antisocial forces will finally be crushed out; but he sees that the process must be slow and stern. If, on his view, justice does not always strike the individual sinner, it falls unrelentingly on the society. If a disregard of morality is nothing but a disregard of the conditions of social welfare, the larger organism is certain to suffer in the long-run for an erroneous or degrading standard. The negative guarantee for the triumph of good principles is, in the last resort, that evil means social degeneration and ultimate destruction. But as the unbeliever holds that the social instincts are in the strictest sense natural; that they tend to strengthen and adapt themselves to the growing needs of society; and that they survive the decay of the particular dialects in which men have uttered their emotions and their speculations, he may reasonably hope that society will develop itself and reach a higher moral standard by a direct growth and at a smaller cost of error and consequent suffering. The ceaseless struggle between good and evil implies the existence of impulses tending both ways, but it may be hoped that, as the race becomes more intelligent and more distinctly conscious of its aims, the victory of good may be won at a smaller cost of error and opposition.

If this be a brief indication of the main lines of the unbeliever's moral theory, we have to ask at what point it conflicts with the believer's tenets. It is undoubtedly possible to state the believer's theory in such a form as to minimize or entirely remove the opposition. Diminish the anthropomorphic element as much as possible; identify God with Nature: and theology becomes little more than a guarantee for the solidity of our methods. If the belief in the uniformity of Nature implies a belief in the divine ruler of Nature, and, conversely, the belief in the order implies merely a belief in a regular order, the question becomes one of those already noticed. We do not ask whether, but why, we believe. One party thinks it necessary to get behind experience; it is not content with knowing without also knowing that it knows, or satisfied with the certainty of a doctrine unless it can be also called necessary. The other party is content to regard belief as an ultimate fact, and to assume, without finding an *a priori* deduction for the so-called uniformity of Nature. I am content to observe that so far there need be no controversy as to practice; the believer and the unbeliever are at one in their methods and results, though differing as to the cause of their validity. It is mere waste of time to bandy charges of skepticism and credulity. But, further, I must say that a theology of this neutral tint and abstract character is not one which really governs men's minds. It is only in so far as the scientific conception is modified that the difference is really important. The question of whether or not it requires a certain guarantee is little better than a scholastic puzzle, except so far as it helps the reintroduction in a disguised shape of ancient fallacies.

When we turn to that kind of theology which undoubtedly makes a relevant contention, we are at once met by a significant difficulty. A belief may fairly be called skeptical in the practical sense which confirms equally a number of conflicting theories. Morality, you say, depends upon theology. Then, is all theological morality identical? It is little better than a juggle to tell us that you alone have an absolutely certain rule if it turns out that you give an equally plausible foundation for mutually contradictory rules. Now, there is no dispute between theologians, or between anybody worth notice, as to the value of certain well-known rules. Nobody explicitly denies that chastity, truthfulness, and mercy, are good qualities. Widely as systems differ, the ordinary code—kill not, steal not, lie not, and so forth—may be regarded as definitively sanctioned by the experience of the race. But go a step further: consider any of the really open questions, and you will find that theologians can take diametrically opposite positions. There is no theory of morality which may not be expressed in theological language. There are theological utilitarians and theological intuitionists. One theologian says that man could not have discovered the moral law without a revelation; another, that morality is a science of observation, and that God simply orders us to pursue the greatest happiness of the greatest number; a third holds morality to be deducible by the pure reason, and infers that revelation and experience are alike superfluous. On one system, the essence of theology is the proclamation of future rewards and penalties. On another, the utterly unselfish love of God is the only foundation of true virtue, which is destroyed so far as it is adulterated with personal interests. One theologian regards the vir-

tues of the heathen as splendid vices; another, as proofs of the universality of the divine influence. One argues that all natural impulses are good, because Nature is God's work; his opponent replies that all Nature is under a curse, and man's heart corrupt at the core. One makes it the foundation of his system that God rules the happiness of man here; another peremptorily declares all happiness here to be an illusion. One holds asceticism to be sheer folly; another holds that it is the only road to heaven. The antinomian thinks that, as God has once for all elected or rejected him, his actions are of no importance; the sacerdotalist thinks that by accumulating meritorious observances he can establish an indefeasible claim upon his creator. One thinks it blasphemy against God's omnipotence to claim any share in the work of salvation; another calls it an insult to God's justice to suppose that salvation will not be conceded to good works. One sees in God's mercy an assurance that all men will be ultimately happy; another infers from God's righteousness that the vast majority will be sentenced to endless torture.

While there is a general agreement as to a certain moral code, there is room for the most contradictory doctrines as to the mode of ascertaining that code—the creed which it contemplates, the sanctions by which it is to be enforced, and the nature of the agents subject to it. The theologian alone possesses a sound basis for morality; but which theologian? On the showing of any one, his opponent builds directly immoral doctrine on the very same bases; and a theory which serves equally to confirm vice or virtue has surely one of the marks of skepticism. But how should it be otherwise when one man's God is another man's devil? When, indeed, the devil is simply a deposed deity, or the product of a process of "differentiation" dating from a period at which there was no difference? Mr. Kingsley's special merit, says one of his admirers, was the clearness in which he drew this rather important distinction. His school of theology is fond of declaring that the God of the Calvinists, that is, of a very large section of their fellow-Christians, is in fact the devil, or at least possessed of diabolic attributes. If devil-worship and God-worship are so intricately blended, the resulting system of morality is not likely to be very coherent. It may be too much to say that the scientific morality gives a simple and coherent answer to all the doubts which infest theology. It would set aside some disputes as meaningless, while others will still continue to be seriously debated. But by excluding the arbitrary data resulting from the heterogeneous elements blended under the common name of theology, by settling the method and by limiting inquiry to questions capable of verification by experience, it at least brings the controversy within the possibility of final solution. The ultimate root of the theological contradictions is that they involve reference to the region of the arbitrary, where no test from experience can be applied; and the most opposite theories are equally plausible.

The theologian contends that his doctrines alone, however much they may have been perverted, can lay down an elevated code or provide sufficient sanctions. The first assertion usually takes the form of a denunciation of "materialism." I cannot here touch upon the metaphysical side of that perplexed controversy, nor repeat in feebler language the reasons which have been set forth by more competent thinkers for feeling tolerably at my ease in presence of this terrible but very indefinite bugbear. We are considering the moral problem; and the theological contention is virtually that, if the old bonds are dissolved, the race will discover the whole duty of man to consist in eating, drinking, and securing the maximum of sensual pleasure. Virtue will be discovered to be a sham, or, as Mandeville put it, the offspring begotten by flattery on pride. We shall accept as the highest good what Mr. Carlyle somewhere defines as an unlimited possibility of pigswash. Nobody, it seems, can deny the reality of the senses, or doubt that sensual indulgence is pleasant within certain limits. But the more ethereal essences, self-sacrificing heroism, devotion to ideal aims, the love which finds in itself its own surpassing reward, will turn out to be mere phantasms and fine phrases. They will vanish from this mad chaos of a world, and society become a blind scramble for the greatest share of the enjoyments appreciable by the lower animals. If man has been developed out of a monkey, he must still be a monkey. What is in the full-grown animal must have been in the germ. The monkey is a prurient lump of fleshly appetites. Man is the same being, *plus* the faculty of lying. If the lies are seen through, he will be the same being without disguise, and may gratify his passions without useless periphrasis.

One question naturally occurs. Are the doctrines imputed to the unbeliever true? If so, the sooner we admit it the better. Every saint and hero in the world is a humbug. He is a brute like the rest of us, a Yahoo trying to throw dust in our eyes. Morality is a clumsy system of rules,

adopted by mutual consent to facilitate the distribution of pigswash. When we have come to an understanding, we shall be able to simplify our code. Even the lower animals learn to behave peaceably when the conditions of life force them into quasi-societies; and man can make rules better adapted for the purpose. The purest selfishness will secure the obedience of the majority to an arrangement in which all find their account. And as, on this showing, nothing but selfishness has ever really existed, we need not doubt its efficiency when it acts with less disguise. But the doctrine—as everybody will reply—is false. The disgust produced by a frank cynicism proves the existence of qualities invisible to the cynic. Virtue, it is said with unanswerable force, could not be invented unless it existed. The hypothetical pig (for I hold the actual pig to possess some rudiments of higher instincts) could not conceive of the existence of any appetite but hunger for pigswash. The argument is conclusive, but proves the futility of the doubt. If the higher instincts undeniably exist, can experience fail to prove their existence? Why shrink from accepting a test which, by its very nature, cannot contradict the testimony of consciousness? This appeal to experience is simply an appeal to that testimony by a definite method. I am conscious of some infusion of pure and lofty instinct in myself, and of sympathy with higher manifestations of them in others. Why should I fear that by any possible mode of interrogation my consciousness will be puzzled into a false answer? No scientific teaching can prove that my senses don't exist, and just as little can it prove that my moral ordinary sense does not exist.

It is, indeed, true that a scientific investigator may, or rather must, deprive this moral sense of its supernatural character. He must endeavor to trace it backward to more rudimentary forms, to determine the conditions of its development, and possibly to show that what we take for a simple is really a complex instinct. But to assume that something has been developed, cannot by any dexterity be twisted into a proof that it does not exist. The belief that the moral sense is the normal product of certain existing forces, instead of being an instinct mysteriously dropped into us from without, strengthens, instead of weakening, our belief in its importance; for such a belief alone can enable us to define the true functions displayed by it, and thereby lead to an external estimate of their vast importance. The conscience is no longer an inexplicable power, giving arbitrary directions upon inscrutable authority; but it is the name of a feeling, or a set of feelings, developed in all social progress, and seen to be essential to the vitality of the race. Nor can any analysis tend to throw a doubt upon the very facts which it begins by assuming, that men are capable of regulating their conduct from lofty and unselfish motives, and that conduct, so regulated, drives the most important wheels in the social mechanism.

The essence, then, of the unbeliever's contention is that the conscience or moral sense is a faculty to be explained (so far as we can "explain" anything) by the ordinary methods, because it is part of the normal process of human development. So far as the believer traverses that contention, he is a skeptic in his theory of human nature. He denies the possibility of virtue except under some external compulsion. He denies the reality of virtue except as conduct regulated by reference to a supernatural world. With him, if it is not disguised vanity, it is disguised fear. Man is a pig, though deterred by the rod of everlasting fire from unlimited devotion to his trough. This doctrine, indeed, is repudiated or masked by the higher theology. By using the same word alternately to describe Nature or a force which opposes and controls Nature—for a whole, that is, or a part—room is secured for any quantity of evasion. It need only be said that, so far as the believer admits virtue to be natural, he is at one with the unbeliever. So far as he asserts it to be supernatural, he illustrates once more the skepticism implied in the argument from the moral character of Christianity; he disbelieves, that is, that any good impulses can arise spontaneously from the corrupt race of man. The tendency comes out more clearly when we turn from the questions about the reality to questions about the sanctions of morality. The believer cannot bring himself to admit that motives drawn from the world around us can be adequate supports of virtue. If he does not hold by hell-fire—a subject which in all seriousness we have ceased to mention to ears polite—he still maintains that man must have a larger stake in the universe than that of his ephemeral existence in the visible world; unless he can look forward to an indefinite vista of futurity, his virtuous instincts will be asphyxiated. They will dwindle when the imagination is confined within the narrow limits of space and time. Our loftiest aspirations are but "survivals" from the time when they could be nourished by hopes and fears of wider date. The unbeliever, it is

said, is under the disadvantage that he cannot argue effectively with the man who deliberately prefers evil to good. He may prove the sinner's conduct to be injurious to society, but not to be injurious to himself. The believer, and the believer alone, can demonstrate vice to be a bad speculation.

Now, it must be frankly confessed that, if hell existed, and could be proved to exist, men would act differently. If we believed in hell, that is, as we believe in Paris, we should be other than we are, though whether better or worse depends upon further considerations. The undeniable fact that the belief produces so little effect as preachers are always telling us, proves that the argument has some weak point in practice. Indeed, one remark is obvious. Allow me to assume the reality of my dreams, and I will produce conclusive argument for any course of conduct whatever; but the assumption is rather a bold one. My argument, you say, would be powerful if its data were sound. That does not show that it is better for practical purposes than one which appeals to less weighty but more real considerations. A penny in cash is more satisfactory than a check for millions upon an imaginary bank. Nor, indeed, is the argument in any case so good as it looks. If virtue is a sham, and hell exists, then you can demonstrate that it would have been better for men not to have been born, but you cannot create in them good instincts. They can be coerced, but not changed without a miracle. If, on the contrary, virtue is a reality, it supplies real motives, which may therefore be sufficient without attempting to fabricate infinite motives. If there is such a thing as an altruist impulse, it can, like all other impulses, be set in motion by strictly finite considerations.

But the force of the argument is destroyed by another remark, which it is convenient to overlook. A law is not effective in proportion simply to the severity of the ruler, but also in proportion to his justice. A tyrant makes obedient slaves, not virtuous subjects. In your anxiety to enforce morality you outrage the conscience. You invent a judge who punishes savagely, who punishes one man for the sins of another, and who punishes frailties for which he is himself responsible. Is it strange that some men refuse to be cowed, and others invent devices for evading your law, as plausible as those by which you would enforce it? The ordinary common-sense of mankind clings to the conviction expressed by the irreverent Omar Khayyam:

"He's a good fellow, and 'twill all be well."

Isn't he? Some believers think so, and infer that God will deal with his creatures by healing their diseases instead of tormenting the sick. A more numerous class has discovered that God, with all his severity, can be propitiated on easy terms. The proper ceremonies or the right state of emotion will induce him to clear all scores, and write paid at the bottom of the account. Science seems to say that Nature never forgives. What has been has been, and what will be depends upon what is. But Omnipotence can make things be as though they had not been, and therefore a miraculous mercy will check the operations of miraculous vengeance. The worst of using dreams in place of efficient motives is, that dreams are surprisingly pliant to men's wishes. It is doubtful whether the conscience has been more stimulated by its fears of retribution or deadened by visions of pardon. Hell is a powerful weapon, for some purposes, to those who believe in it, but in practice it tends to provoke either revolt or evasion, as much as to enforce obedience.

Such considerations may help to explain why it is that the moral standard of the race has been so little affected by theological stimulants. If a theologian could prove that vice involves absurdities so great as to make it impossible, we might be grateful to him. But no one can assert, and the theologian persistently denies, that the unlimited application of this imaginary scourge has really made the race better. Thinking of all the atrocities perpetrated under the religious *régime*, of its frequent effect in absolutely deadening the conscience, of the false standards which on any hypothesis it has often substituted for the true one, of the indirect injury done by crushing the intellect or the moral nature from a cowardly fear of possible abuses, one may be almost tempted to doubt whether its effect has been elevating or deteriorating. The truth is, that we are touching upon a problem of extreme complexity, which is obscured by all kinds of confusion. What, one may ask, is the relation between the creed and the moral standard actually recognized by a race? To approximate to an answer, we should have to distinguish between true and sham beliefs, to make allowance for the tacit repeal of one set of doctrines ostentatiously advanced by another set covertly insinuated, and to estimate the innumerable indirect influences of the creed upon the whole social structure. One consideration, however, will be enough for my present purpose.

Nobody will deny that men's actions are

governed by their beliefs and emotions; but when we attempt an accurate analysis of motives, we are met by the difficulty of allowing for the complex reactions between the reasoning, feeling, and active parts of our nature. What we call beliefs may be really dreams; and, in early stages of thought, the element due to genuine observation and that contributed by the imaginative faculty are inseparably blended. The alteration of a genuine belief may alter conduct as the alteration of the external facts would have done. The facts, it may be said, *are* changed for the observer; and, therefore, his mode of behaving will change. But the alteration of a dream cannot be taken as the ultimate, though, of course, it may be the proximate, cause of such a change, for it must be itself due to some change in the character or surroundings of the dreamer. The dream represents men's desires; it shows what it is which they hope or fear, or what is for any reason impressive to their imaginations; a change in it must be taken to imply some change in those hopes and fears produced by an independent process.

Thus a changed belief as to a future world may greatly modify our conduct, so far as that belief was a real attempt to interpret experience. If, as Paley maintained, virtue meant simply action regulated by prospects of a future life, the destruction of that belief would destroy virtue. It would not directly alter character, but it would close one channel for the display of selfish impulses, and might indirectly come to modify character also. The doctrine of the unbeliever must be different. On his showing, the belief in another life was probably due, in the first instance, to an attempt to interpret experience. So far as we now interpret it differently, our conduct may be altered. But it is plain that all that colors the belief, all that makes the future life an object of hope and fear, must be differently explained. Since heaven and hell were not revealed from without, they must have been suggested from within. A given person may, of course, have believed in hell on the authority of his Bible, and have been guided by his fears as he would by any other fears. But since the whole phenomenon—the belief of a race or society in a "future state of rewards and punishments"—can rest upon no ground of outward experience, its genealogy is clear. It proves what men hoped and feared, not what they inferred from external facts. There is no presumption, then, that by destroying it you destroy the desires on which it existed. You simply force them to take a different form. Destroy the belief in the pagan gods, and you destroy the old poetic machinery, but you do not therefore destroy the poetic impulse.

The believer may, therefore, hold consistently that men are kept in order by external threats, and that the virtuous impulses, if they exist in the natural man, would droop and die without such support. To the unbeliever, this explanation is not open. Fetters framed by men for themselves cannot be the ultimate cause of the restraint. It would be as unphilosophical to suppose that a man can lift the platform which supports him. We cannot look outside the world to explain the maintenance of a certain moral standard, any more than we need look beyond the solar system to explain why the earth does not fall into space. The existence of these imaginary worlds becomes with the unbeliever a conclusive proof of two things: first, that men, or the leading minds among mankind, must have hated vice, for the thought of its punishment was agreeable; secondly, that they aspired to a better state of things, for they constructed an ideal world where justice should be perfectly administered. If a man works because he believes that he is to be paid, the work may be done against the grain. If he believes that he is to be paid because he likes to work, the work must have some independent charms.

Is it possible, then, that the closing of this outlet for the imagination will cause the atrophy of the instincts which prompted its construction? The unbeliever hopes and believes better things. He thinks that men's hopes and aspirations will not fail, though directed to definite reality, instead of the boundless imaginary world. He regards it as a fact capable of strict scientific proof that altruistic instincts exist; that men have desires which can only be explained when man is regarded as a fraction of the social integer; and that those desires, depending upon conditions other than dreams, will survive the disappearance or modification of the dreams. The existence of such instincts may appear a paradox to some reasoners. A belief in them is the mystery of the unbeliever's creed, against which the pride of reason is apt to revolt. It is not my present purpose to justify the doctrine, or to show (as I hold that it may be conclusively shown) that it involves no real offense to reason. It is enough to say that, so far as it is an essential part of the unbeliever's theory, whereas it may be rejected by his antagonist, the believer may most fitly be called skeptical. He declares a fact to be contradictory because it will not fit

in with his doctrines, and therefore throws a doubt upon the validity of experience. The skepticism in this case is merely one mode of stating the skeptical doctrine already illustrated —namely, the disbelief in the natural goodness of man. So far as the supernatural code or sanction is asserted to be necessary, the insufficiency of the natural is more or less explicitly maintained.

Which creed, then, is most skeptical in the sense already defined—least calculated, that is, under existing circumstances, to produce coherent and consistent action? The unbeliever loses the use of certain phrases, or reduces them to intelligible meaning. The moral law, says the believer, is eternal, immutable, supreme, infallible, and founded on the nature of things. It is just as eternal, says the unbeliever, as the laws of Nature upon which it is founded. As all reasoning assumes the continuity of past and future, we can never look forward to a time when the law will be essentially changed. It is immutable in the sense that, while the conditions remain, the law must remain; but it is susceptible of modification and adaptation to new circumstances. It is supreme as it expresses the ultimate conditions of social welfare, and the race can never fail to observe those conditions without ruin to itself, and therefore to the component individuals. It is certain, if not infallible, for, though we renounce supernatural guarantees for our moral beliefs, and admit that they cannot be deduced from *a priori* necessity, we can place them on a level with other conclusions of inductive science. It is founded in the nature of things, if by things you mean, for example, man and his surroundings; but we know nothing of the transcendental nature of things, which is the home of the arbitrary, the absolute, and the self-contradictory. We cannot be more than certain, nor say what is "absolute morality," any more than we can say what is that absolute health which is independent of our physical constitutions. The attempt to get beyond this is an attempt to get off our own shadows; and only leads to a show of absolute conclusions at the price of finding them to be meaningless and arbitrary. And, finally, to use a much-abused term, the moral law is clearly "objective," if it is meant by that phrase that it does not vary arbitrarily with the fancies of different men, but expresses truths about human nature as sure and final as the truths of astronomy; though, if objective be used to imply an existence independent altogether of the constitution of our minds, we can only reply that such words are meaningless.

The unbeliever, then, cannot admit that he has really lost anything. If it be still asked what he has gained, he may reply that he has escaped from a skepticism of the most distressing kind. That creed is least skeptical in the practical sense which is most conducive to hope. When the early Christians believed in a coming millennium, or modern revolutionists in the perfectibility of the species, each creed must have been stimulating. The vision of the early triumph of the right was not the cause, but the effect, of a faith, flushed with excessive confidence, and capable of transforming, if not of regenerating, society. The difference is characteristic. In dropping the belief in a millennium for a belief in progress, the unbeliever holds that he is dropping the shadow for the substance. The hopes of the believer point to dream-land and therefore to a world of catastrophes and surprises. They suggest convulsions instead of development. Everything is to be changed in a moment, in the twinkling of an eye, at the sound of a supernatural trumpet. The world has been, and therefore may be, the scene of tremendous and spasmodic transformations, to be anticipated only in virtue of supernatural knowledge. God came upon earth to reveal the one truth, and to establish his divine kingdom. Strange to say, the light has grown dim as knowledge has advanced, and, when the next catastrophe occurs, faith may have disappeared from the world. The new kingdom has so little attracted the allegiance of mankind that the moral standard has improved slowly, if at all, and has often improved by absolute defiance of the acknowledged representatives of the ruler. The only hope is in another catastrophe which may shatter to pieces the whole existing order, and introduce a new system, in which good and evil, hitherto so intimately blended, will be eternally divided. So strongly does this conviction color the believer's view, that the last defense of orthodox theory rests on a scientific argument to prove that the universe must have gone through a complete catastrophe within some finite period, and will probably have another before long—which is very consoling, and proves the existence of God.

What better proof that belief is, in fact, skepticism?—that it obtains a show of certainty by banishing all certainty from the world of experience to place it in an arbitrary world of abstractions? The assumption, which underlies all scientific reasoning, of the necessity of judging

of the future from the past, is systematically rejected. The belief in the millennium has vanished and the outlook for this world is hopeless or uncertain. The devil is getting the best of it here, though he may receive his deserts hereafter. Faith grows dim as knowledge increases; or, in other words, reason destroys all ground of hope. Progress is a failure, for the past was better than the present. In presence of all the great movements which stir the world, the believer's attitude is one of doubt, suspicion, or absolute hostility. Increase of knowledge makes him tremble for his creed. Social changes involve the decay of the one sacred authority. If he forces himself to believe that, in some sense, a reconciliation between the old and the new is yet possible, he is forced to equivocate, to strain words into no meaning, and to look with doubt upon his allies. He is haunted by vague dread of materialism and atheism, and fancies that science will somehow be able to juggle him out of confidence in the most explicit testimony of his consciousness. Belief in progress is handed over to the unbeliever, not only because the winning side naturally believes that things are improving, but because he alone can assign some ground for the belief. Measuring the future by the past, he can infer that the evolution of which we see the earlier phases will pass through others, as yet but dimly discernible, though dimly encouraging.

The ultimate result, then, of the believer's skepticism as to human nature is that the belief in progress has been transferred to his rival. Now, the belief in progress in some one of its many shapes is the most characteristic product of modern habits of thought. It is simply the doctrine of evolution applied to political and social theories; and it must permeate and transform all such theories in proportion as they become scientific. A similar transformation must be effected in our moral conceptions. Theological language may, of course, be accommodated to this new doctrine, as there are no doctrines to which it cannot be accommodated. But the instinctive repugnance of theologians to such a belief rests upon a sound logical instinct. The theologian naturally denies the validity of the methods and assumptions upon which the belief in progress primarily rests, for he regards a knowledge of the unknowable as an essential condition of foreseeing the future. And the imagination still acts more powerfully than the logical faculty. The vision of a supernatural world becomes vivid precisely in proportion as our interest in this becomes dim. If the two conditions are not logically opposed, yet in practice one waxes as the other wanes. We cannot really walk with our eyes fixed both upon cloudland and upon solid earth. Dreams and realities may blend for a time, and the dream be transformed instead of abruptly dispelled. But we have ultimately to choose, and, as we choose, we must become skeptical as to this world or the other.

By progress, it only remains to be said, we cannot mean a continuous and indefinite process of improvement. Periods of darkness and partial decay may always be destined to intervene between periods of growth and enlightenment. The planet itself will ultimately, we are told, become a mere traveling gravestone, and before that time comes men and their dreams must have vanished together. Our hopes must be finite, like most things. We must be content with hopes sufficient to stimulate action. We must believe in a future harvest sufficiently to make it worth while to sow, or, in other words, that honest and unselfish work will leave the world rather better off than we found it. Perhaps this is not a very sublime prospect. Life, says the most candid of theologians, and his arguments certainly support his conclusion, is perhaps but a poor thing. But it is a tolerable world so long as one can believe that one's fellow-creatures have plenty of healthy instincts, and enough of really noble instincts to secure a steady, if checkered, social growth; that those instincts do not depend upon our attaining impossible knowledge, and that they will survive all the petty systems founded upon irrational guesswork. It is something to feel a certainty, based upon experience of the case, that we have nothing to fear from unlimited freedom of inquiry, and that we may hope, not merely an indefinite increase of man's power over the external world, but a higher and more rational social order and more widely-reaching sympathies. Extended knowledge means a more accurate appreciation of the conditions of human welfare, and a more intelligent cultivation of the emotions and sympathies upon which it depends. We can work and think without fearing that some infidel Samson will suddenly bring down the pillars of the temple. We cannot flatter ourselves that our personal stake in the universe is more unlimited in regard to the future time than in regard to the past and the distant; but possibly the reflection is consoling to some people who think that they will have had about enough of themselves in the threescore years and

ten! That, perhaps, is a matter of taste; but, in any case, when all intellectual progress is seen every day more clearly to depend upon the systematic interpretation of experience and the resolute repression of all incongruous elements of speculation, it is desirable that we should gaze in the direction in which alone experience can enlighten us, and accept realities instead of dreams. The skepticism which rejects the phantoms is less paralyzing than the skepticism which, when it expresses itself frankly, rejects realities, and, when it does not, attempts to mystify us by a jargon which hopelessly confounds the two. —*Fortnightly Review.*

THE BRITISH ASSOCIATION.

AT a gathering like that of the British Association, which this year revisits Plymouth after a long absence, the value of the work done in the several sections is in truth quite independent of what may happen at the general meetings, which have a comparatively spectacular character, and whose object is to provide a sort of medium between the intimate scientific work of the Association and the diffused interest of the educated public. At the same time this object is an important one, and the remembrance of the proceedings left in the minds of outsiders in any given year—and consequently the amount of support beyond the pale of the properly scientific world which may be counted on to furnish the sinews of war—must depend in great measure on the impression made by the opening address. It is a thankless office to have to record, as we are now compelled to do, that this time the impression was not a very favorable one. In one word, the president's discourse was much too technical for the occasion and the audience. It would be ungenerous to cast any personal responsibility for this result on the eminent specialist who was chosen for the office. The gift of interpreting the results of highly-special researches for the benefit of those who are not prepared beforehand by special knowledge is by no means a common one—in fact, it is itself a specialty which very few have mastered; for which reason people who are anxious to parade themselves as amateurs in science are much in the habit of cheapening it. The notion that Prof. Huxley and Prof. Tyndall are mere popularizers—because, forsooth, they can expound as well as discover—has almost attained the rank of a vulgar error. Some remarks to that effect were heard at this very meeting in the Guildhall of Plymouth. Those who imagine that such remarks give them a scientific air may be assured that there is no more certain stamp of a narrow and superficial habit of mind. However, we cannot all go to Corinth; a specialist, however eminent, has not necessarily the gift of large and lucid exposition; and if he has not, the temptation to take refuge in the technical details of his own province is almost irresistible. Dr. Allen Thomson was himself aware of the danger, and made a sort of apology by anticipation. As far as he is personally concerned, the apology must be fully accepted. He began with a general review of the history, position, and prospect, of the Darwinian theory, which left nothing to be desired. This first part of the discourse, though not strikingly brilliant in form, was an excellent specimen of a kind of scientific literature of which England has especial reason to be proud. It was quite fair, again, for the president, being what he is, to lay special stress on the evidences of Darwinism in biology; and a passing notice of the current controversy on spontaneous generation was in every way fitting. Here Dr. Thomson declared himself in favor of those who hold that no production of really new organic life has been shown to take place under the present conditions—in other words, he adopted the germ-theory; at the same time he was careful to point out that the problem of the first origin of life on the earth remains quite open, and that no conjecture yet advanced does more than put back the difficulty. So far all was well; but presently the turn of the discourse became further specialized, and the audience found themselves listening to a severely technical lecture on embryology. Its main purport was clear enough, indeed, to those who knew in a general way what to expect. To others we think it must have been obscure. The president's speech was now of blastoderm, ectoderm, and endoderm, epiblast and hypoblast; and the less physiological part of the audience began to wonder if they had not strayed by mistake into the biological section. Ignorance being the mother of fear, there were signs of alarm lest something improper should be coming; one or

two very discreet persons were observed to walk out. If they had staid, they would probably have carried away nothing worse than a more or less hazy notion that Haeckel and Von Baer were very great men, and that the amphioxus and ascidians have become families of much greater consideration within late years. From indications we shall presently have to mention, it seems that Plymouth orthodoxy is still susceptible on the topic of evolution; and it might perhaps have had a calming effect to assure the good citizens of all respectable denominations that the amphioxus is a particular *bête noire* of those particularly naughty people the positivists. We have not heard, however, that Prof. Huxley has been in high favor at the Vatican since Dr. Congreve put him under the ban of Humanity.

To return to Prof. Allen Thomson, the general tenor of this more special part of the address was to set forth the parallel between the development of kinds, as conceived by the Darwinian naturalist, and the embryonic development of the individual as it may be seen in any of the higher animals, from the microscopic ovum upward through the various stages that lead to the finished form. On the evolution hypothesis, every such stage is the record of a condition once present in adult ancestors of remote generations; and this furnishes an explanation—how complete must be left for specialists to decide, but certainly the only explanation yet known—of phenomena in embryonic life which otherwise seem purposeless and unaccountable. Prof. Allen Thomson left no doubt as to his own opinion; he pronounced the evidence of embryology in favor of the continuous development of species to be not only strong, but practically conclusive. It is impossible for an embryologist not to be an evolutionist; no theory which does not include the leading ideas of evolution—namely, variability, adaptation, and hereditary transmission—can bring the facts of embryology within a general law. The connection and continuity of all organic life force themselves irresistibly upon the "faithful student," him who follows, according to Plato's precept, whithersoever the reason of the thing leads him, not looking to the right hand or the left.

Such were the general features of the address, which, valuable as was the matter, somewhat failed, as we have said, in immediate effect. It was read with a tone of calm and equable familiarity proper for a discussion among experts, but hardly calculated to fix the attention of a mixed audience on the details of embryonic development. There was likewise another drawback, and one wholly beyond the president's control. The wise men of Plymouth seem to regard Darwinian doctrine as dangerously strong meat for their fellow-citizens, and the speeches that introduced and followed the discourse of the evening were apparently designed, instead of setting off and heightening its effect, to extenuate it as much as possible. The mayor introduced Dr. Allen Thomson in a rambling oration (not unjustly received with bare civility), in which he took occasion to mention in an emphatic manner that, if the British Association studies the book of Nature much, the men of Plymouth study the book of Revelation more. It is true that Plymouth is distinguished above other towns for the variety, vehemence, and eccentricity, of its sectarians. It was reserved for the Mayor of Plymouth to discover that the temperament which has produced three rival sets of Plymouth Brethren is peculiarly favorable to the formation of a sound judgment on scientific speculation. After this he launched into a display of classical allusions, in which Ajax and Prometheus got sadly mixed up. However, Dr. Allen Thomson was Prometheus, and, if he did not meddle with fire, nobody would peck him. The suggestion of a "winged hound of Zeus" in the background who tears presumptuous men of science was not in the best taste. Then, after the address, the Earl of Mount Edgcumbe proposed the usual vote of thanks to the president, and said he thought the wisest course for the Association in such difficult matters as had been put before them was to "take their president's advice, and, instead of coming to rash conclusions, reserve their judgment so long as that branch of science remained in the region of hypothesis." This was a pretty bold piece of accommodation, considering that the president, so far from giving any advice of the kind, had said, as distinctly as words could say it, that in his opinion only one judgment was possible. Whether the Earl of Mount Edgcumbe really meant that he disagreed with Dr. Allen Thomson on his own ground, but did not like to say so, or whether he had any more subtile meaning, we shall presumably never know. Last came Dr. Acland to second the vote of thanks, and professed himself specially thankful to Dr. Allen Thomson for not having trespassed "in a light and useless way" on the forbidden ground of metaphysics. The terms of this compliment seemed intended to imply a censure on Prof. Huxley and Prof. Tyndall for their well-known Belfast addresses, and to suggest in a delicate way to the good folk of Plym-

outh how grateful they ought to be to the Association for not troubling them with any such superfluity of naughtiness this year. Now, it may be observed, simply from the Association's point of view, that the high problems of mind and matter, at all events when handled by masters of exposition, are far more interesting than the development of epiblast and hypoblast, and much more likely to serve the objects for which it is chiefly worth while to have opening addresses at all. But this also is to be observed—and is far more important—that men of science need not and will not submit to purchase toleration by renouncing the right they have, no less than all other men, to discuss questions which lie at the foundations of science, and are of the deepest interest for all thinking persons. As on the one hand they will not go out of their way to meet the so-called challenges of people who have not learned the elements of scientific method, so on the other hand they will from time to time pause in their special inquiries, when and where they think fit, to consider the bearing of established facts or probable hypotheses on the general conception of the world to be formed by a reasonable man. We believe that no doctrine about physical events, whether it be the conservation of energy, natural selection, molecular theory of gases, or anything else, can furnish proof or disproof of any metaphysical doctrine, though it may show in particular cases that something professing to be metaphysics is really bad physics. But it is perfectly idle to deny that the state of physical knowledge at any given time does materially affect the notions of mankind, both physical and metaphysical, about the order of Nature as a whole. Else why has science, as it has always had, determined enemies in those who are or fancy themselves committed to keeping up particular sets of notions? The pretense of ignoring or deprecating these wider influences is unworthy of men who serve knowledge with a whole heart. Their business is to go straight onward, without fear and without favor, neither courting nor shrinking from speculative consequences, and least of all affecting to be, alone among all men, incompetent to discuss them.

—*Saturday Review.*

TREATMENT OF ANIMALS.

By W. C.

IN our youthful days in the early years of the present century, little consideration was given to a systematic kindness to animals. Horses were overwrought without mercy, when ill-fed and with wounds which should have excited compassion. If they sunk down in their misery, they were left to die, the chances being that, in their last hours, they were inhumanly pelted with stones by boys; no one, not even magistrates or clergymen, giving any concern to the cruelties that were perpetrated. All that we have seen, without exciting a word of remonstrance. A wretch who habitually turned out his old, overwrought, and half-starved horses to die on the town-green, never incurred any check or reprobation. His proceedings were viewed with perfect indifference. People, while passing along in a demure sort of way to church, would see a crowd of boys pitching stones into the wounds of a dying horse, and not one of these decorous church-goers endeavored to stop these horrid acts of inhumanity. Like the Pharisees of old, they passed on the other side. Such within recollection is a small sample of the unchecked atrocities of our young days. Cats were pelted to death. Birds'-nests were robbed. Dogs had kettles tied to their tails, and were hounded to madness by howling multitudes. Oxen were over-driven to an infuriated condition, and their frantic and revengeful career formed an acceptable subject of public amusement.

Barbarous in a certain sense as these comparatively recent times were, there had already been shown instances of a kind consideration for animals. The poet Cowper, it will be recollected, wrote touchingly of the hares which he had domesticated. Sir Walter Scott's tender regard for his dogs has been recently noticed in these pages. There was here and there a glimmering consciousness that animals had some sort of claims on the mercy of mankind. What strikes one as curious is that society had retrograded in this respect. The oldest laws in the world, found in the early books of the Old Testament,

enjoin a kind treatment of animals. If we see an ass fall which belongs to some one with whom we have a cause of difference, we are to throw aside private feelings, and hasten to help the animal. We are not to take a bird when sitting on its eggs, or on its young; a most humane injunction. In various texts the Hebrews were enjoined to have due regard for the comfort of the ox, the ass, or any other animal which labored for them. In these venerable records mercy is enjoined toward all living creatures.

The modern world, with all its pompous claims to civilization, strangely drifted into an entire neglect of these beneficent obligations. Throughout Christendom, any laws enforcing a kind treatment of animals are few in number, and of very recent date. Even within our remembrance, clergymen were not usually in the habit of inculcating that species of kindness to domesticated creatures which we read of in the Old Testament; nor were children ordinarily taught lessons of humanity within the family circle. The oldest statutory laws concerning animals are those for the protection of game; but these laws proceeded on no principle of kindness. They were intended only to protect certain birds and quadrupeds during the breeding-season, with a view to what is called "sport," the pleasure of killing them by licensed individuals—the license for indulging in this species of luxury being, as is well known, pretty costly. It is not our wish to hold up "sport" of a legitimate kind to ridicule. The chief matter of regret is the coarse way in which game is sometimes pursued and killed even by licensed sportsmen: their operations in what is known as a *battue*, when vast numbers of animals are driven into narrow spaces, and shot down and maimed without mercy, being, as we think, no better than wholesale butchery; and not what might be expected from persons of taste and education.

Although in the early years of the present century there were no laws for the specific purpose of preventing cruelty to animals, thoughtful and humane persons were beginning to give attention to the subject. In 1809 Sir Charles Bunbury brought into the House of Commons a bill for the "prevention of wanton and malicious cruelty to animals." Mr. Windham, a cabinet minister, little to his credit, opposed the bill, and it failed to pass. The next attempt at legislation on the subject was made by Lord Erskine in the House of Lords in 1810. His measure was opposed by Lord Ellenborough, and had to be withdrawn. There the matter rested until 1821, when Mr. Richard Martin, member of Parliament for Galway, brought a bill into the House of Commons for the "prevention of cruelty to horses." It encountered torrents of ridicule, and, after passing a second reading in a thin House, was no further proceeded with. Mr. Martin, however, was not discouraged. He felt he was right, and returned to the encounter. In 1822 he introduced a new and more comprehensive bill. Instead of horses, he used the word "cattle;" this bill passed through all its stages, and became an act of Parliament. This act of 1822 was the first ever enacted against cruel and improper treatment of animals. Let there be every honor to the memory of Richard Martin for his noble struggle on behalf of defenseless creatures. In 1825 he brought in a bill for the suppression of bear-baiting and other cruel sports. Not without surprise do we learn that Sir Robert Peel met the bill with determined opposition, and that it was thrown out. To think that so eminent a statesman as Peel should have been a supporter of bear-baiting! No fact could better present an idea of what was still the backward state of feeling among educated persons on the subject of cruelty to animals.

The year 1826 found Mr. Martin still at his post. He framed a bill to extend protection to dogs, cats, and other domesticated animals, from cruelty. In this it might have been expected he would have been successful. But no. His arguments to move the House of Commons were unavailing. Mr. Martin died in 1834. Not until 1835, when more enlarged ideas prevailed, was there an act to throw a protecting shield over cattle in the market, on the way to the slaughter-house, and in the roads and streets generally; over all such animals as dogs, bulls, bears, or cocks, kept for purposes of baiting or fighting; over all animals kept in pounds or inclosures without a sufficiency of food or drink; and over all worn-out horses, compelled to work when broken down with weakness or disease.

It was reserved for the beneficent reign of the present queen to see a comprehensive act of Parliament for the prevention of cruelty to animals. This was the act of 1849 (which was extended to Scotland in 1850), that now forms the basis for prosecuting cases of cruelty, and may be called the charter which conferred on domesticated animals a right to protection. Lamenting the backwardness of England in establishing such a charter, it is not without pride that one knows that England was, after all, the first country in modern times to enforce the principle that the

lower animals are entitled to be protected by law. That principle, as we have shown, is not new. It was recognized by the ancient Hebrews, and it is pleasing to feel that at length modern commonsense has legislatively assumed its propriety. Latterly, there have been several additional acts of Parliament, chiefly as concerns protection to sea-birds and small land-birds; but, while well meant, these acts are very imperfect. The eggs of sea-birds not being protected, the nests of these animals may be rifled with impunity. As regards small birds, a number are left out in the list of protected animals—the skylark for one. These deficiencies are unfortunate. Sea-birds, though generally looked on with indifference, are of great public utility. They benefit agriculturists by eating the worms and grubs in newly-ploughed land; they hover over parts of the sea and point out where there are shoals of herrings and other fish; they are useful to the mariner in foggy weather, by their warning cries near the rock-bound coast. How beautiful that arrangement of Nature, in making provision for birds to live on shelving rocks by the sea-shore, there to act like beacons, in warning off the bark of the mariner from a coast that would cause its destruction! Considering that wonderful provision, how scandalous, how short-sighted, the practice of rifling the nests of sea-birds! A supplementary act to protect the eggs of sea-birds cannot, as a matter of public duty, be too soon passed. Already, on some parts of the coast, sea-birds are said to be rapidly disappearing.

As every one knows, dogs are often lost in large towns, and roam about miserably in search of their master or mistress. A sight of them in such circumstances is exceedingly pitiable. In the metropolis, a humane plan for succoring lost dogs has been established. Some years ago, a benevolent lady, Mrs. Tealby, was enabled, by the aid of public subscriptions, to set on foot a temporary Home for Lost and Starving Dogs, which has existed since 1860. It is situated at Battersea Park Road. Any dog, when found and brought to the Home, is taken in and succored under certain necessary conditions. If a dog, after being housed and succored, is applied for by the owner (with satisfactory proof of ownership), the animal is given up on payment of the expenses of its keep. If no owner comes forward, every unclaimed dog is sold for the benefit of the institution, or otherwise disposed of according to circumstances. The Home is growing in usefulness. In one year recently more than thirty-three hundred dogs were restored to their former owners or sent to new homes. Many owners who recover their favorites through the agency of this institution not only refund the expenses incurred, but assist the funds by subscriptions in the name of their recovered pets—as, for instance, "In memory of Pup," "For little Fido," "In name of darling Charlie," "The mite from an old dog," and so on. This deserving and well-managed institution is well worth visiting. Only, the visitor must be prepared to see painful demonstrations from some of the unhappy inmates. On the approach of the visitor, each animal eagerly hastens to see if he be his dear master. And when a sniff and a glance render too evident the fact that you are not the person wished for, something like a tear steals from the poor doggie's eye. The happiness shown when one of the animals finds his lost master is equally expressive. Looking to the great good done in the cause of humanity by this meritorious Home for Lost and Starving Dogs, it may be hoped that efforts will not be wanting to establish similar institutions elsewhere.

There is another admirable establishment worth referring to. It is known as the Brown Institution, from having been founded by the bequest in 1851 of a large sum of money by Mr. Thomas Brown. Its design was the advancement of knowledge concerning the diseases of animals, the best mode of treating them for the purpose of cure, and the encouragement of humane conduct toward animals generally. The institution combines the quality of an infirmary and a dispensary for animals belonging to persons who are not well able to pay for ordinary medical attendance, and therefore does not trench on veterinary establishments. Several thousands of animals are treated annually. The institution, which is under the direction of the Senate of the University of London, is situated in Wandsworth Road, near Vauxhall Railway-Station. As a hospital and dispensary for poor horses, dogs, and other animals, the Brown Institution is unique of its kind. As far as we know, there is nothing like it in the world. What a prodigious step in advance is the Home for Dogs, and the institution now described, from the condition of things at the beginning of the nineteenth century!

In speaking of the improved treatment of defenseless creatures within recent times, a prominent place is due to the Royal Society for the Prevention of Cruelty to Animals, located in Jermyn Street, London. Standing at the head of all organizations of the kind in the United Kingdom, this society may be considered the

watchful guardian of the rights of animals, and without whose agency the laws we have enumerated would, as regards England, stand a poor chance of being enforced. The business of this society is conducted mainly by the employment of persons all over the country to find out cases of cruelty, and to bring the offenders to justice. The society diffuses handbills and placards in places where they may come prominently under the notice of persons likely to infringe the law. It further has issued various publications calculated to stir up the feelings in behalf of animals.

The handbills and placards deserve special notice. Sheep salesmen are reminded that convictions have been obtained against persons for ill-treating sheep by cutting and lacerating their ears, as a means of identifying them from sheep belonging to other consigners. Shepherds are warned, by a cited example, to abstain from a specified mode of treating sheep for certain maladies; because pain is inflicted, which a veterinary surgeon knows how to avoid, but which an ignorant though well-meaning shepherd may not. Farmers are reminded that it is a punishable offense to crowd too many sheep together on going to market; instances being cited in which eleven sheep were crammed into a small cart, with their legs tied tightly together. Captains of freight-steamers are informed that penalties have been enforced against a captain for so overcrowding his vessel, on a voyage from Holland to the Thames, as to cause the sheep much pain and suffering; carriers and cattle-barge owners are under the same legal obligations.

In regard to cows, one placard cautions persons sending them to market with the udder greatly distended with milk, and from which the poor animals evidently suffer much pain. Cattle-rearers are told that penalties have been enforced against one of their body for sawing off the horns of fourteen heifers so close to the head as to cause blood to flow in considerable quantity, and to make the animals stamp and moan; the object of such a mode of cutting being to increase the market value of the horns. Butchers are reminded that it is a punishable offense to bleed calves to death merely for the sake of giving additional whiteness to veal. Consigners and carriers are alike reminded that the act of 1849 imposes fines or imprisonment as a punishment for conveying animals in such way as to subject them to unnecessary pain or suffering; the neglect to give proper food and water to the animals, whether coming to market, at market, or in removal from market, is announced in another handbill to be an infringement of the same statute.

Drovers, by another handbill or placard, are cautioned against urging on cattle which by lameness are unfitted to travel along the roads and streets; and against striking animals on the legs so violently as to lame them: both are practices to which drovers are too prone, and both are punishable. Farmers, graziers, and salesmen are alike warned that the season of the year should be taken into account in the transport of shorn sheep. "It is hardly conceivable that respectable farmers and graziers, merely for the sake of profit, can in the months of December, January, February, March, or April, cruelly strip a dumb animal of that warm woolen coat which the goodness of God has provided more abundantly in winter to protect it from the cold weather; or that any English salesman will lay himself open to a criminal charge of aiding or continuing the offense by exposing shorn animals for sale at such inclement seasons."

Horses and donkeys find a place in the safeguards which the society endeavors to provide, by disseminating placards and handbills pointing out the penalties for cruelty or neglect. It is an offense against the laws to work a horse in an omnibus, cab, or other vehicle, when in an infirm or worn-out state. It is an offense to beat a horse in a stable with a degree of severity amounting to cruelty, merely to make it obedient, or, still worse, through an impulse of angry passion. It is an offense to set a horse to drag a cart or wagon loaded with a weight beyond his strength; many coal-merchants and their carmen have been prosecuted and fined for this unfeeling conduct. It is an offense to cruelly beat and override poor donkeys; useful animals which seem fated to be the victims of very hard treatment in the world. It is a significant fact that one placard is addressed to "excursionists and others:" those who have witnessed the treatment of donkeys by their drivers, at Hampstead Heath, Blackheath, and the humbler grades of sea-side places where holiday people assemble, will know what this means. The society aid the inspectors of mines, or are aided by them, in bringing to justice truck-drivers and others for working horses and ponies in an unfit state in coal-pits.

It was not likely that dogs would be left out of sight by the society; the maltreating of such animals is the subject of some of the cautionary placards, especially in localities where rough persons, prone to dog-tormenting, are known to be

numerous. Cats are the subjects concerning which other warnings are given, in regard to torturing or cruelly worrying. Fishmongers are reminded that it is a punishable offense, which many persons commit, of "putting living lobsters and crabs into cold water, and then placing them on a fire until the water is heated to boiling temperature, thereby causing them to endure horrible and prolonged suffering."

That the feathered tribes should share the protection which the issuing of these placards is intended to subserve, is natural enough; seeing that the Sea-bird, Wild-bird, and Wild-fowl Acts were due in a great measure to the society. One placard states that it is a punishable offense to kill or wound any such birds (including the young in nests) within the prohibited period; and that those who sell such killed birds are also punishable. Another placard administers a similar warning in regard to wild-fowl, enumerating thirty-six species, all of which are to be safe from the gun, the snare, and the net, from the 15th of February to the 10th of July, under penalties which are prescribed in the act of 1876. Bird-fanciers are reminded that one of their fraternity was imprisoned for fourteen days for depriving a chaffinch of its sight as a means of improving its singing. Poultry-dealers are, in another hand-bill, cautioned against plucking live poultry, a cruel practice which, if proved, subjects the offender to three months' imprisonment. Carrying live fowls to market by their legs, with their heads hanging downward; and exposing fowls to hot sunshine with their legs tied together — have brought the offenders into trouble. In another placard the patrons of pigeon-matches are warned that occasional cruelties practised by them or their servants come within the scope of the law. In one of the society's publications, the cruelty of bearing-reins for carriage-horses is significantly pointed out.

The society has been encouraged in its benevolent exertions by a letter from her Majesty the Queen, addressed in 1874 to the Earl of Harrowby, in his capacity as president. There was an assembly in London of foreign delegates representing similar associations, on the occasion of the holding of the half-century jubilee of the parent society. Her Majesty requested the president to give expression publicly to her warm interest in the success of the efforts made here and abroad for the purpose of diminishing the cruelties practised on dumb animals. "The queen hears and reads with horror of the sufferings which the brute creation often undergo from the thoughtlessness of the ignorant, and she fears also sometimes from the experiments in pursuit of science. For the removal of the former the queen trusts much to the progress of education; and in regard to the pursuit of science, she hopes that the advantage of those anæsthetic discoveries from which man has derived so much benefit himself, in the alleviation of suffering, may be fully extended to the lower animals. Her Majesty rejoices that the society awakens the interest of the young by the presentation of prizes for essays connected with the subject, and hears with gratification that her son and daughter-in-law show their interest and sympathy by presenting those prizes at your meetings."

Looking to the distinguished patronage of the society from her Majesty downward, its vast array of supporters, and the large number of societies which it has helped to originate at home and abroad, we naturally rely upon it for promoting a consolidation and expansion of the laws against cruelty to animals. These laws, as has been seen, are composed of shreds and patches, brought into existence with difficulty, and in many respects imperfect. The time appears to have come when the whole should be combined in a statute applicable to all parts of the United Kingdom. That certain actions should be deemed cruelties punishable by law in England and not in Scotland, is anything but creditable, and not a little ludicrous. This is a point to which the attention of legislators should be seriously invited. From the fragmentary and confused condition of the statutes, we have experienced much difficulty in ascertaining what, as a whole, the law really is. This chaotic state of things detracts, we think, not a little from the glory which may be freely claimed by the English for their legislation in behalf of animals. A consolidated act with all reasonable improvements would be something to point to with satisfaction, and probably go far to insure a legalized system of kind treatment of animals all over the globe.—*Chambers's Journal.*

MR. PONGO.

IT is a specialty of places of public entertainment in England that the approaches to them shall be made as deterrent as possible; that the persons whose duty it is to admit the public shall wear an aspect of gloom and grudge, as of men who know how mistaken one is in supposing one is going to see anything for the shilling entrance-fee, and would prefer to warn the public off the premises, but, such an act of charity being forbidden, would at least suggest by their grumpy carelessness the vanity of human expectations with regard to the particular entertainment beyond their respective doors or turn-tables. Who has not noted the surprise, the discomfiture, the sudden falling of the spirits, of foreign visitors, when they face for the first time the bare-boarded, backwoods'-hut-like approaches to the temples of art, science, and *bric-à-brac*, at South Kensington; the insecure, slanting passages, like nothing but the improvised covered way to Mr. Myers's circus-stable, which lead to the jocosely-styled Horticultural Gardens flower-shows; and the squalid disorder of the Low-Level entrance to the Crystal Palace, which combines a rickety and dangerous staircase from the outside with some dirty pens inside, through which the aspirant to the delights of the palace hurries, over loose, filthy, unevenly-laid boards, but in which he is confined on his way back to the train, under conditions similar to those of a "lock-up," where the tenants are habitually disorderly? We have always put up with things of this kind—was not there a perceptible undercurrent of misgiving when decent entrances to certain theatres were "introduced," by managers whose minds had been influenced by foreign customs in this respect?—and we probably always shall put up with them; but still we must air our grievances concerning the entrances to the Aquarium at Westminster, the dreariest place by daylight—that is, unless our experience was exceptional—within our knowledge. Not the gentle melancholy of which Dickens writes as mostly characteristic of places where one is encouraged by advertisement to expect a "happy day," but a stronger feeling, akin to dismay, takes possession of the visitor who has passed through the creaking turn-table and the doors, with the rough handles which he is to "push" or "pull," according to circumstances, and finds himself in the dingy vastness of the Aquarium, where the tanks are thinly occupied by a few common specimens of fish, often not of the kinds indicated on the cards supposed to guide the visitor to their contents, and where the smaller cases, containing the tortoises, water-serpents, and baby-alligators, are exceedingly foul-smelling. Dust and dreariness—both of which, of course, may be accidental—are the pervading elements of the "entertainment," as of so many others; the floor when we visited it was as dusty as that of any metropolitan station; the walls and pillars are disfigured with advertisements; the flowers and shrubs are of the commonest kinds; the galleries are narrow walks between dust-laden rails and tables, covered with ghastly models of fish, and specimens of the blighted hopes of the Zoölogical Gardens. A plaster cast of an infant hippopotamus, with one leg broken off short, and a "preparation" of monkey, are among the cheering objects which one encounters on one's dusty way to the inconvenient corner at which one finds the narrow door through which one passes to an audience of the distinguished gorilla, Mr. Pongo. At a dirty table stands a boy, who distributes dirty cards of admission to a space in a gallery formed by a rough inclosure of boards, leaving a narrow passage—exactly like the prisoners' way in a police-court, with the coarsely-papered wall of the gallery on one side—which is fitted on three sides with rows of chairs, the two-shilling seats being in front, and offering no advantage whatever over the one-shilling seats, except to persons of lively imagination, who discern some in the red rope at their back. A space, with a raised floor, inclosed within wire-work, and furnished with a couple of chairs, a horsewhip, a ladder, and a brown blanket, forms the scene of the exhibition of Mr. Pongo, and his friends—August, the chimpanzee, and the dog Flok. As the audience collect, the depression of disillusion is to be read in their faces. What was the necessity for stowing away the object of so much reasonably expected attraction in a dirty corner, and surrounding him with deterrent accessories? The outer edge of the gallery is shut up with a suffocating curtain, lest a glimpse of the bewildering delights below should be caught by the dismal assemblage who wait for the appearance of Pongo, and a boy, shrill and irrepressible as Dr. Ginery Dunkle (of Troy) himself, screams incessant admonitions about the taking of tickets,

even while Mr. Pongo's German attendant is laboriously enunciating the few sentences in English in which he relates the history and describes the habits of his interesting charge.

Mr. Pongo is a very nice beast, but he is not so clever as August, nor so sympathetic as Flok, and one feels about him after a little while as one feels about the heavy child in a nursery—that he is good and safe, but hardly amusing. There is something disconcerting about him, too, though it is in one's own mind, not in him; it is the inclination to treat him rather as a human being of the unintelligent than as an animal of the exceptionally intelligent kind. One speaks to him with marked distinctness and emphasis, and pets him, not with the flippant smartness one would bestow upon "Nature's Punchinello," his companion, but gravely, and with an effort to make him understand, as one might pet one of the harmless "cases" at the Earlswood Asylum. In the quiet heaviness of his manner there is something that makes one feel patient and painstaking, as with a creature of slow brain and perception; and when he claps his dreadfully human hands, with the black skin in wrinkles on them like ill-fitting gloves, and pounds them on the floor, demanding notice and applauding himself, one claps and nods at him just as one would at a deficient child. He is singularly dumb, too, rarely uttering any sound at all, while one of his friends chatters freely, and the other barks in all the exuberant delight of games of play, of which Mr. Pongo is for the most part only a spectator, decidedly at a disadvantage where general liveliness is in question. When seated on the ground, with his gray back, his round, neatly-formed head, with comparatively small and close-sitting ears, turned toward one, his long arms folded, his spare small legs, so disproportionate in size to his powerful arms, hidden, his lean thighs tucked close to his thick, bulging, ridgy sides, he is wonderfully like a very strongly-built child to whom "rickets" has come unaccountably, and in contradiction of his apparent constitution. Mr. Pongo's face is amiable, and his attendant declares him to be "very good-natured;" the eyes are serious and quiet, by no means so melancholy as the eyes of most monkeys with whom we have previously been acquainted; and when he hitches himself against the wires of his cage, his legs extended, one arm lying negligently across his lap, and the other indolently raised while he lazily scratches his head, he reminds one of *Punch's* pictures of an Irish Fenian, without the ferocity, the tattered tail-coat, and the brimless hat. He is not four years old, but he looks fifty, and there is not the contradiction between his face and his manners which exists in the case of most monkeys, for his demeanor is likewise middle-aged. Not, perhaps, that he remembers the Gaboon, his captivity, and his slaughtered relatives, but that he thinks solemn spectators who don't talk to him a bore, and the corner of the Aquarium gallery dull. He is said to be fond of children, and he certainly brightened up when some came in, but they were shy of him, and did not respond to his hint that a little applause would be agreeable. He gravely climbs the ladder up which August skips with derisive ease, and tests the strength of the wire-work screen of his cage with nice attention; but he seemingly makes up his mind each time that it will not "bear," and relinquishes the attempt to follow the dauntless chimpanzee, who rushes about overhead doing daring trapeze-feats, dangling himself by the ropes, just out of reach of the barking and jumping dog, and mocking the much superior strength of Mr. Pongo by his far greater agility. Sometimes he has a friendly rough-and-tumble with Flok, or gives August an admonitory cuff and roll-over; but for the most part he sits on the floor, watching their play, or arranging his blanket, in which he packs his feet up exactly as we have seen children pack their feet up in their blankets on winter nights, and he uses his hands in these operations in a thoroughly human way. Very like a man and a brother is he also when he drinks out of a bottle, grasping it in both hands, putting his head well back, and emptying the last drop down his throat. It is quite a pleasant diversion from the close resemblance when, his attention being attracted to another chance of securing the much-disputed blanket, he transfers the bottle to his foot, holding it firmly with the toes. His slight, flat, small-heeled feet are more like those of a man than the feet of any other monkey, we are told, but the likeness ceases with the toes; these are fingers, and have all the movements of fingers; nor is the face human below the brow and eyes. The absence of a nasal promontory; the wide, sunk black nostrils, like those of a hippopotamus on a very small scale; the semicircular sweep of the mouth; the thick, calf-like tongue, and something in the action of the jaw and throat, when the animal lifts up his head and one sees him from the side, which also reminds one of a calf, form an unlikeness to the human race as forcible as the resemblance in other respects is striking.

Mr. Pongo is in excellent health now, but has

had two illnesses since he was sold to Dr. Falkenstein, of the Prussian Natural History Expedition, for two gallons of rum, and exchanged his chain in an African village for the more tolerable conditions of his European career. Perhaps he was too young when the hunters took him to have any dreams now of the deep, cool, dark forest, the great luscious fruits, the glorious climbs, and bounds, and fights, the long migrating journeys of the gray-coated community, the booming, inarticulate speech which was the language of his tribe; and it may be that he is happy enough in his artificial life. It includes all the necessaries and many of the luxuries of civilization. He goes to bed at eight every evening, "in a very comfortable bed, and sleeps till eight in the morning," his attendant told us, "always lying on his side, with his hand under his cheek on the pillow, like a man," and he eats numerous meals with unfailing appetite. Once a day he has an ample repast of roast meat and potatoes; and his breakfast, luncheon, and supper, consist of milk, wine-and-water, bread, rice, eggs, fruit, and vegetables. He is on the best of terms with his attendant, and it was very funny to see him lying negligently on his back in a slanting-upward position on the ladder, his eyes turned up to the ceiling, one hand dangling downward, and the other thrown round the neck of his friend, as the latter repeated his brief formula to a freshly-arrived batch of spectators. Mr. Pongo had quite an irresistible air of enjoying the proceeding; he rolled his tongue about, and when the sentence, "His present value is £5,000!" was spoken, he withdrew his arm, gave the speaker a friendly cuff, as who should say: "What! you're at it again, are you? Fetch 'em with figures, my boy!" and dived rapidly over and under the rung of the ladder, looking at the audience upside-down from between his own legs, with a composed gravity infinitely comical. He never attempts to stand upright; he is too heavy, his attendant explained, and his legs are not yet strong enough to support his weight. But it is expected that he will grow to a height of six feet, and then stand upright, as the full-grown gorilla has been seen by travelers to do. At present his mode of progression is like that of a tumbler who is about to be picked up suddenly by a pinch behind from the clown in the ring. He walks on his feet and his hands—the latter turned in, fist-shape, and looking like small club-feet—and his back slopes gently down from his broad shoulders to his thin, misshapen flanks. Mr. Pongo is an interesting if not precisely a fascinating animal, and the strongest proof of his quaint suggestion of kinship with his visitors is, that one is never free from a queer sense of bad manners in asking questions about him before his grave, black face; and that one leaves him with a wish that he might have something to do, or at least something to read.

—*Spectator.*

Siberian Natural History.—Dr. O. Finsch, lately returned from a scientific expedition to Siberia, has opened at Bremen an exhibition of the ethnographic and natural history collections made by him during his travels. The specimens have been duly classified by Dr. Finsch himself, and, according to *Die Natur*, whose account of these valuable collections we follow, give a good general idea of the kind of life led by the inhabitants of Western Siberia; in this respect they surpass even the Imperial Museums of St. Petersburg and Moscow. The inhabitants of the whole region of the Obi, lying north of the confluence of the Irtish with that stream, live exclusively by fishing, hunting, and reindeer-breeding. The reindeer is the principal source of their wealth, but the herds have been ravaged during the last forty or fifty years by splenitis, and thus the people have been reduced to great straits. For instance, we are informed that Ivan Taisin, Prince of Oddorsk, who twenty years ago owned 7,000 reindeer, now has only 700. Dr. Finsch's ethnographical collection consists of the following groups: 1. Women's and children's clothing, articles of feminine adornment, needles, and thread, etc.; 2. Household furniture and culinary utensils; 3. Men's clothing; 4. Instruments used in hunting and trapping; 5. Sundry other implements, together with requisites for smoking; 6. Fishing outfit; 7. Articles used in public sports and in gaming; 8. Reindeer-harness; and, 9. Objects used in religious worship. Besides, there is a complete state dress of a Tungu notable, as also sundry specimens of Turkistan and Siberian manufactures. The natural history collection includes a portable herbarium, a great herbarium of plants from the Altai region, mosses, arctic berries, butterflies, beetles, bees, flies, locusts, spiders, shells, reptiles, fishes, and birds, the last in great variety. Then there is a collection of human skulls, and a number of paleontological specimens. Finally, the economic products of Siberia are represented by specimens of skins, farm-produce, manufactures, ores, and metals.

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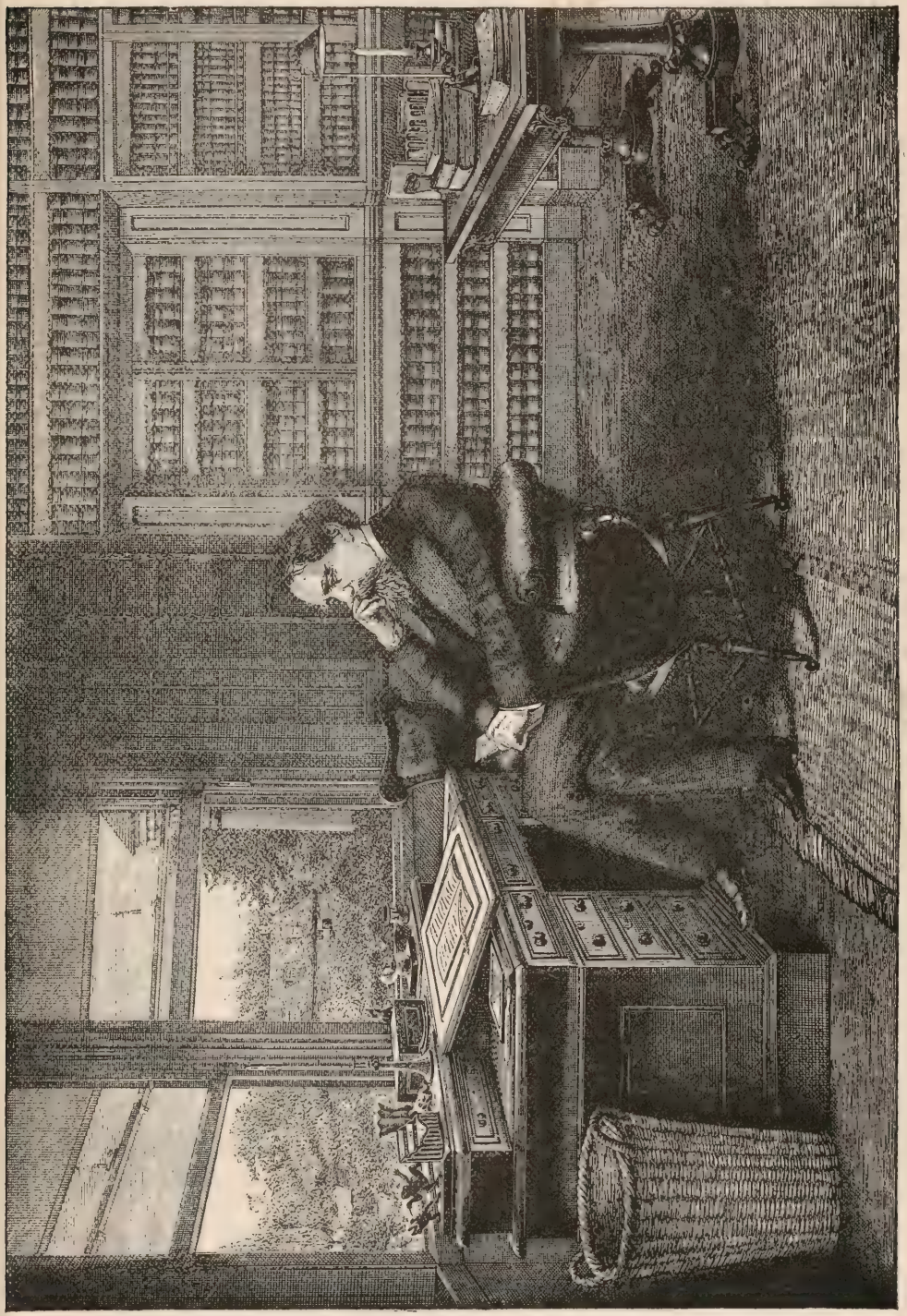

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